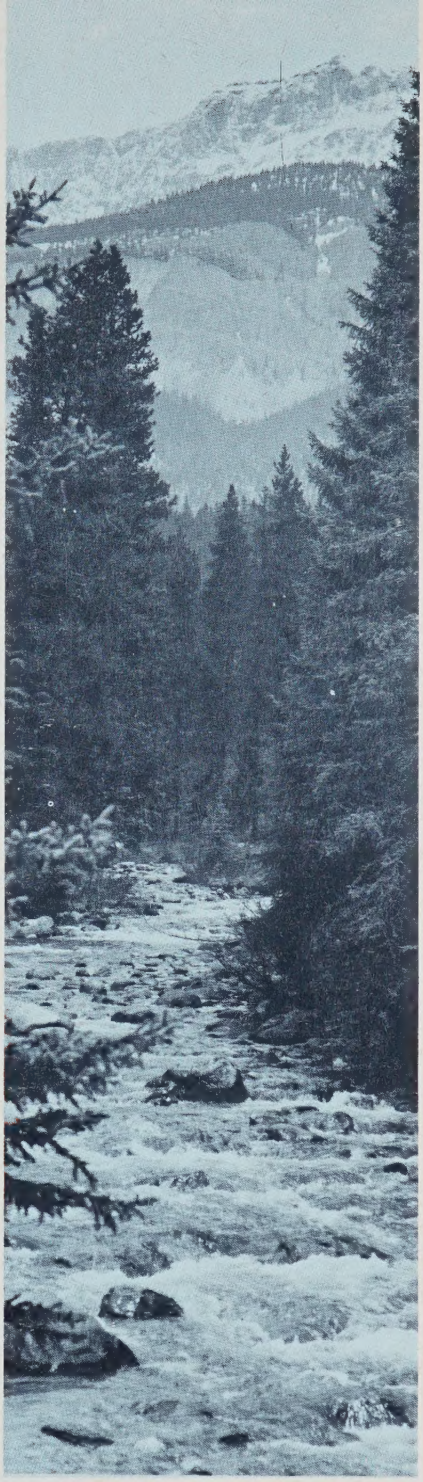
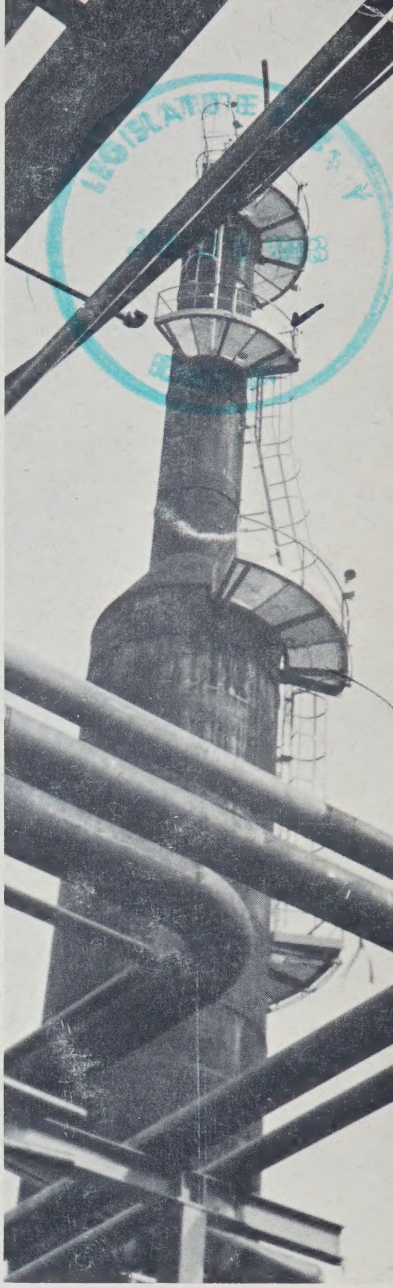




alberta
department
of the
environment

HON. W. J. YURKO, MINISTER

DR. E. E. BALLANTYNE, DEPUTY MINISTER

G. L. Nielsen

WEST EDSON WATER SUPPLY

May, 1972

WATER RESOURCES
DIVISION

Water Resources Division

R.E. Bailey - Director
W. Solodzuk - Chief Engineer

Soils, Geology and Groundwater Branch

L.D.M. Sadler - Branch Head

Dr. G.L. Nielsen - Geoscience Section

G. L. Nielsen

WEST EDSON WATER SUPPLY

May, 1972

WEST EDSON WATER SUPPLY

FIGURES

TABLES

INTRODUCTION

In early March, 1972, A. R. Isbister and A. R. Grover, Field Services Branch, Department of Municipal Affairs, contacted Water Resources Division to supervise well construction and aquifer testing at West Edson. This work was to be done in co-operation with Stanley Associates who have designed water and sewage systems for the hamlet. Stanley Associates prepared tenders and Hi-Rate Drilling, Stettler, was selected for the drilling, final well construction and aquifer testing.

WORK DONE

A site was selected for a test hole which would be convenient to the proposed distribution system, and which an earlier report (Nielsen, 1969, p. 32) indicated was over the Edson gravel aquifer. All wells mentioned in this report are located on Figure 1. Upon drilling at this site on April 19, 1972 however, no gravel was found and the site was abandoned. The lithologic log of this test-hole, 72-1, is in Table 1, and the electric log in Figure 2.

Water Resources Division and Stanley Associates then decided to drill a second test-hole just north of the CNR tracks in lsd. 4-16-53-17-W5, near Glenwood Cemetary. Access was given by the Town of Edson, which owned the land.

Well 68-13P (well numbers are those used in Nielsen, 1969) which had been completed as a pumping well, was only 670 feet south, but was not considered as an economical water supply well. Land aquisition costs, extra pipeline construction, and a railway crossing appeared to bring the final price to that of a new well.

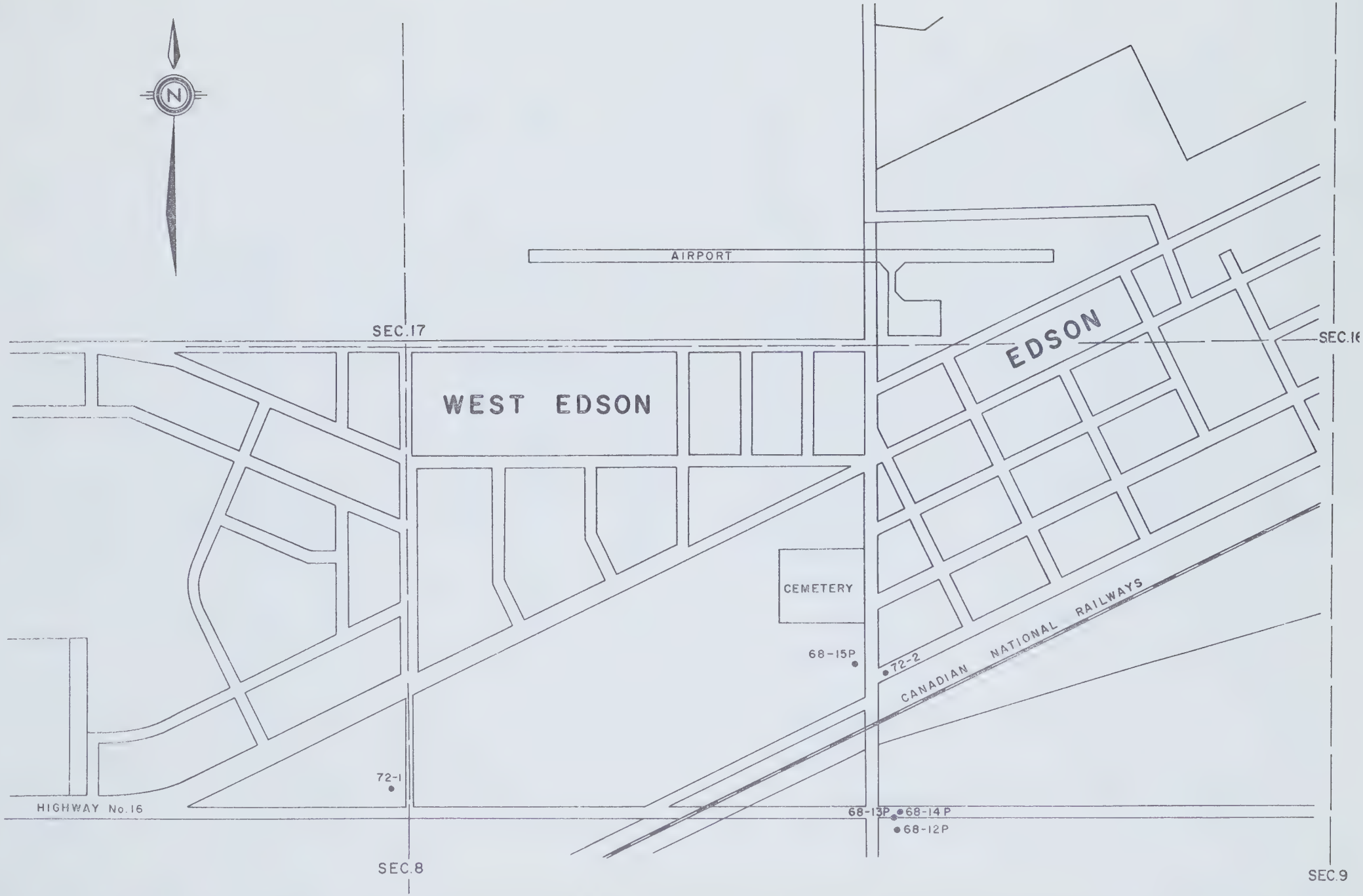


Figure 1. LOCATION MAP OF WELLS AND TEST-HOLES

SCALE : 1"=750'

TABLE 1. Well Summaries

Well No.: 72-1

Location: SE cor. - 1sd. 3-17-53-17-W5

Date: April 19, 1972

Elevation: 3030 ft. (from topo. map)

Driller: Hi-Rate Drilling, Stettler

Total Depth: 100 feet

Depth to bedrock: 88 feet

Log:

Lacustrine -	0 -	10	Clay, lt. brn.-yel. v. sticky
Till -	10 -	44	Clay, pbls. sdy, lt. brn-yel. sft.
	44 -	54	Shale boulder, sdy. m. gy.
	54 -	88	Clay, pbls. sdy, m. gy.
Paskapoo Fm. -	88 -	100	Sandstone, v f, m gy, sft.

Ran electric log, 2 feet to 99 feet, then abandoned.

Well No.: 72-2

Location: NW cor. - 1sd. 4-16-53-17-W5
100 ft. east of road allowance, 15 ft. north of CNR fence

Date: April 22, 1972

Elevation: 2991.10 (from top of joint on casing)
2990 ground level

Driller: Hi-Rate Drilling, Stettler

Total depth: 134 feet

Depth to bedrock: 128 feet

Log:

Lacustrine -	0- 30	Clay, lt. bf., v. sft.
	30- 63	Silt, lt. gy, v. sft.
	63- 82	Silt, lt. gy, v. sft. coal frag.
Till -	82-117	Sandy silt, lt. gy, pbls,coaly hd.
Saskatchewan Gravel -	117-128	Gravel, m. sandy
Paskapoo Fm. -	118-134	Ss. m. gy, s&p, vf, sft. arg.

Ran electric log, 3' to 128'

Completion: Installed 119 ft., 8" O.D. casing.
Set 10 ft. of 6" x 40 slot stainless steel Johnson screen at 118 - 128 ft.
Gravel packed with 17 sax #8-12 mesh frac. sand, making 3" layer around screen
Developed with 600 cu. ft. compressor ½ day

Distance to observation wells used in pump-test.

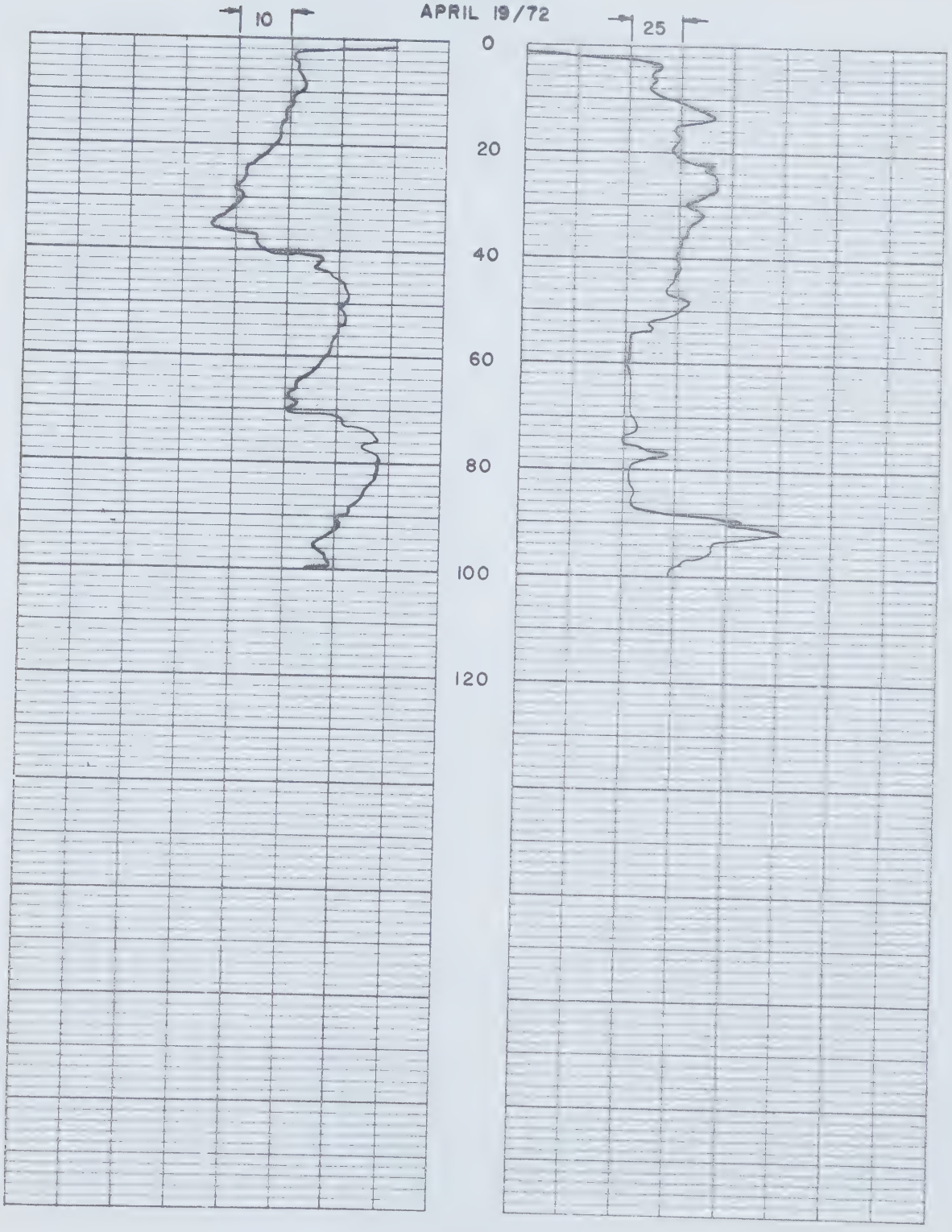
68-15P - 227 feet
68-13P - 670 feet

HI-RATE DRILLING, WELL 72-1

L.S.D. 3-17-53-17-W.5

G.L. 3030

APRIL 19/72

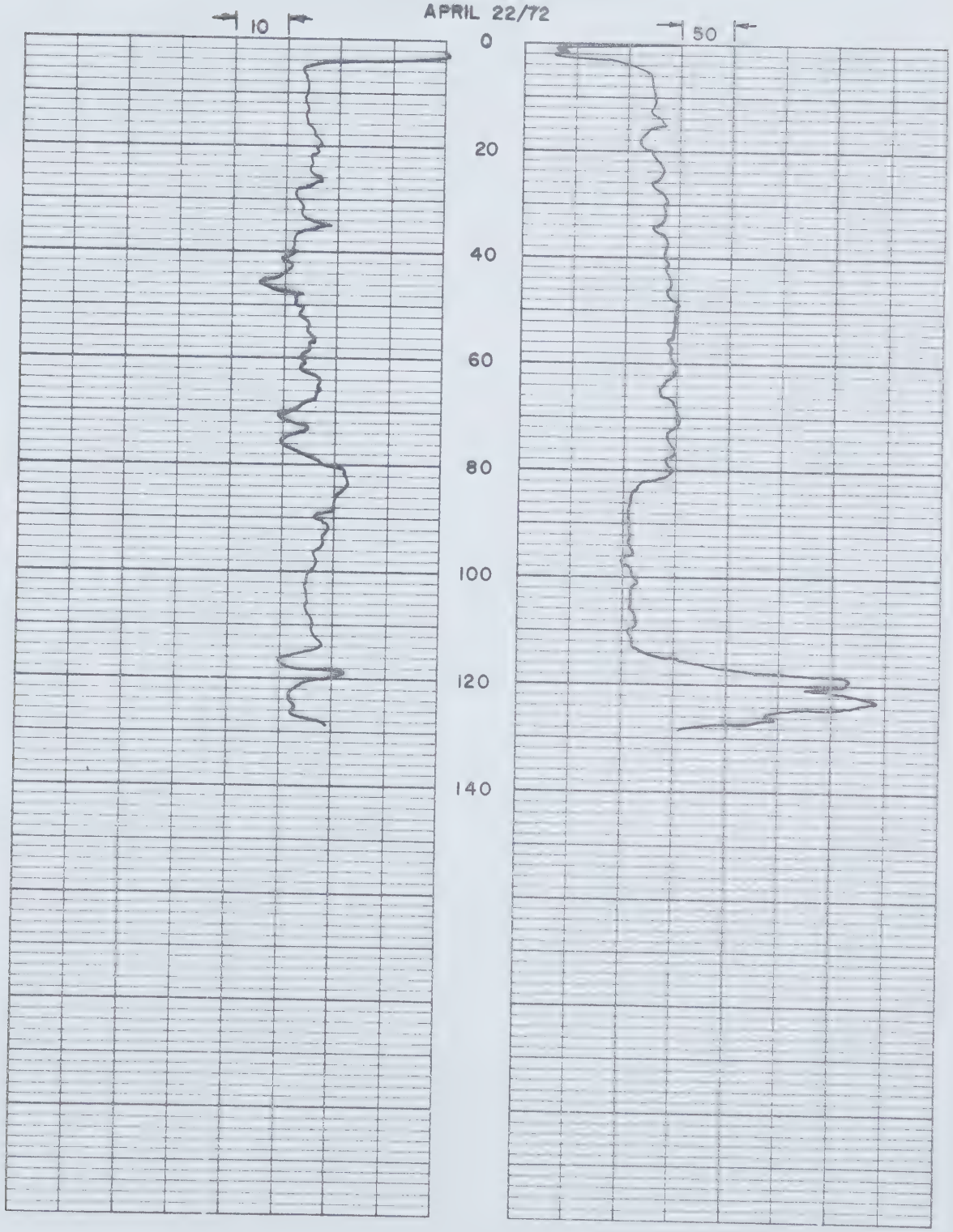


HI-RATE DRILLING, WELL 72-2

L.S.D. 4-16-53-17-W.5

G.L. 2990

APRIL 22/72



On April 21, 1972, test-hole 72-2 was drilled and twelve feet of gravel were found. Conditions appeared favorable for a permanent well, and it was therefore constructed and developed, from April 23 to 24, 1972. Well log and construction details are in Table 1. The electric log is shown in Figure 3.

INTERPRETATION OF AQUIFER TESTS

A. Step-drawdown test, 1972

On April 25, 1972, a pump was installed at 120 feet depth in the completed well 72-2, and a step-drawdown test was run. Three steps of one-hour duration each were run, at 15 gpm, 32 gpm and 50 gpm.

Lennox (1966, p. 33) discusses an analysis of step-drawdown tests by which it may be determined whether turbulent flow conditions prevail in any of the steps. In his technique, Sw/Qn, or drawdown divided by pumping rate is calculated at the end of each step. If the resultant values are approximately the same for all steps, laminar flow conditions prevail.

In this test, Sw/Qn increased with each step, thus indicating turbulent flow. The interpretation of data, using Lennox's and Sheahan's (1971) methods to predict well loss values for pumping rates above 50 gpm led to untenable and ridiculous figures. Mogg (1968) demonstrates that step-drawdown tests are an unreliable means of doing so, except inasmuch as the several steps may actually include or bracket the final pumping rate.

Moreover, the indications of turbulent flow in this step-drawdown test are considered as misleading because the pump was set within the screen. The driller had done so in order to avoid cutting his riser pipe. As a result, turbulence probably resulted from most of the water being pumped from the two to three feet of aquifer directly opposite the pump. Installation of the final pump at the proper depth will no doubt reduce the initial well

loss considerably. Determination of final safe pumping rates were based on extrapolation of well loss figures from the step-drawdown test as a safety factor. All pump-test data and plots are in the Appendix.

B. Pump-test of well 72-2.

A constant-rate pump-test was conducted from April 26 to May 3, 1972, for a total length of one week, at 50 gpm. Well 68-15P, 227 feet northwest, and 68-13P, 670 feet south were used as observation wells, and thus it was not necessary to drill new observation wells for this test. It was found that variations in barometric pressure caused greater fluctuations of water level than did the pumping itself. Records of barometric pressure from the Edson Airport (one-half mile north) were plotted against water level fluctuations under non-pumping conditions (Figure 5) so that such fluctuations could be removed from the time-drawdown curves. The higher barometric pressures prevalent during some parts of the test could not be corrected with as great an accuracy as were the lower ones. Thus water level measurements taken during such times were less meaningful than they might have been. Table 2 lists the aquifer coefficients calculated from this test and from a re-evaluation of the 1968 test.

Transmissivity of the pump well was 52,800 ig/ft/day for the pumping test, and 60,000 for the recovery (Figure 6). Well loss was 10.9 feet and total formation loss was 1.2 feet after 7 days (or 4 log cycles of time). Available drawdown is about 26 feet. For a projected well yield of 100 igpm, total formation loss over 20 years (7 log cycles of time) will be (1.2/4) (7) $(\frac{100}{50})$ = 4.2 feet. Well loss will be, at greatest, 20 feet, projected from results of the step-drawdown test. Other pump tests conducted at Edson in the same aquifer typically had well losses of perhap 5 to 7 feet for tests run in excess of 100 igpm (Research Councial of Alberta files).

TABLE 2. Aquifer Coeffficients calculated from 1968 and 1972 Tests

Well No.	Year	Transmissivity	Storativity
68-12P	1968	5,400	1.8×10^{-3}
68-13P	1968	66,000	-
	1968 (recovery)	113,000	-
	1972	94,000	1.7×10^{-4}
	1972 (recovery)	110,000	2.0×10^{-5}
68-14P	1968 (recovery)	113,000	6.9×10^{-3}
68-15P	1968	66,000	1.8×10^{-4}
	1972	88,000	-
	1972 (recovery)	88,000	-
72-2	1972	52,800	-
	1972 (recovery)	60,000	-

Therefore, for the reasons mentioned in discussing the present test, well loss will no doubt be substantially less than the 20 feet allowed.

This analysis ignores the effects of vertical leakage down through the aquitard over the aquifer, which would ultimately contribute to well yield. The extent of this contribution may be calculated approximately by Walton's equation, using the average values from Nielsen (1969, p. 36). Total water percolating vertically into the channel is given by:

$$Qc = (P'/m') \Delta h \, Ac$$

where Qc = leakage through confining bed, in gpd

P' = vertical permeability coefficient, in gpd/ft.

m' = thickness of confing bed, in feet

Δh = difference in head of the aquifer and source bed in feet

Ac = area of confining bed through which leakage occurs, in square feet.

Using the average values of coefficients derived in 1969, and assuming a circular cone of depression of 800 feet radius, vertical recharge could be

$$\left(\frac{.07}{115}\right) (65) (3.14 \times 800 \times 800)$$

$$= 7.9 \times 10^4 \text{ igpd}$$

$$= 55 \text{ igpm.}$$

Thus, it is possible that 55% of the anticipated 100 igpm could ultimately come from vertical recharge.

C. Re-evaluation of 1968 pump-test, well 68-13P.

The tranmissivity values derived from the pump test of well 72-2, using 68-13P and 68-15P as observation wells, were all much greater than those obtained from the 1968 aquifer test. Inasmuch as the 1968 test also included well 68-13P as the pumping well, and 68-15P as an observation well, it was decided to re-examine the data.

The 1968 test was run for 4 days at 30 igpm. The drawdown and recovery curves for the pumping and observation wells all contained considereable scatter due to barometric fluctuations. Such fluctuations cover a wide range and occur rapidly in the Edson area, except during winter months.

The original 1968 data were correlated to some extent to barometric variation, but the curve of water level vs barometric pressure used at that time was not very useful. In order to re-interpret this test, the 1968 barometric pressure changes were corrected, using the 1972 curve (Figure 5). Although the results were not entirely satisfactory, especially at higher pressures, useful drawdown curves resulted for 68-13P, 68-12P, and 68-15P. Useful recovery curves were obtained for 68-13P and 68-14P. Other tests were not used as they contained too much scatter to yield reliable results.

This interpretation shows that ther is an area of high permeability in the vicinity of the wells used. A pronounced barrier exists a short distance south of 68-12P, probably being finer gravel or silty gravel within the aquifer.

WATER QUALITY

Water from well 72-2 has been analyzed both for bacteriological and chemical suitability for human consumption. Two bacteriological tests were done, and neither shows any indication of harmful bacteria or contamination. The results of the chemical analysis are shown in Table 3. This water is soft, and well within acceptable chemical limits as set by the Department of The Environment. Fluoride is close to the ideal content for optimum dental protection.

DESIGN OF WATER SUPPLY SYSTEM

Although present needs of west Edson are about 50 igpm, the system design projects future needs up to 100 igpm. Well 72-2 will provide adequate

TABLE 3

Chemical analysis of Groundwater, Well 72-2

Date: May 5, 1972

Temp. 41.6°F

pH	8.2	
Specific conductance	850	mmho/cm
Hardness, total	36	ppm
Calcium	10	ppm
Magnesium	2	ppm
Iron	0.2	ppm
Sulfate	74	ppm
Chloride	1	ppm
Nitrate & Nitrite	0.1	ppm
Fluoride	1.05	ppm
Total dissolved solids	740	ppm
Alkalinity	510	ppm

water for present and future needs based on these figures.

To protect the well and maximize its useful life, the final pump installed should be choked back to produce 50 igpm until such time as greater demand warrants an increase. The well will operate more efficiently at this lower rate than it would if the pump were continually starting and stopping while pumping at a higher rate. Pump motor life will also be greater.

Should demand exceed the capacity of well 72-2, 68-13P could be added to the system at a later date. Twenty years of pumping at 100 igpm of 72-2 has been shown to create at most, a maximum drawdown of 24 feet out of 26 feet available. If well 68-13P were added to the system and pumped at 60 igpm, analysis of the 1968 data shows (Figures 9 to 12) that an additional 2 feet of interference (including barrier effects) would result at 72-2. Likewise, pumping of 72-2 at 100 igpm would add 2 feet of interference at 68-13P after 20 years (Figure 13).

In summary, the well yield of 72-2 will adequately meet present and anticipated the needs of West Edson for the forseeable future. If actual growth outstrips projected estimates, an additional water supply at 68-13P is readily available. The water is clear, sand-free, and of acceptable quality for human consumption.

MANAGEMENT OF WELL SYSTEM

Municipal groundwater use must be licenced under recent amendments to the Water Resources Act. The purposes of such licencing are: protection of prior rights from damage caused by new groundwater diversions; and protection of the licencee in turn from future encroachment on his supply. Certain safeguards and means of monitoring the water supply have been established by Water Resources Division, Department of The Environment, in order to assess properly the effects of groundwater diversion.

Basic to protection of the groundwater resource and its users is a means of measuring its effects in the vicinity of a diversion. This is done by periodic measurement of water levels in wells and by metering the amount of water withdrawn. It is therefore recommmended that a meter be installed at well 72-2 or at the point where it discharges into the reservoir. The meter should be read and water volume recorded daily. The water level in the pumping well and well 68-15P should also be measured and recorded daily, with measurement done about the same time of each day. Since well 68-15P is 227 feet from 72-2, these measurements will adequately reflect aquifer behavior in the vicinity of the pumping well.

There are no other users of this aquifer within a 1.5 mile radius. The Town of Edson has several wells in this aquifer at greater distances to the east, and the town now monitors its wells regularly. No conflict of use should arise between these two municipalities. Regular measurements of aquifer behavior, as outlined above, will be of value in settling such conflicts, should they ever arise.

REFERENCES

Lennox, D. H. 1966. Analysis and application of step-drawdown test; Journ. Hydraul. Div., Proc. A.S.C.E., vol. 92, No. HY6, Proc. Paper No. 4967, Nov., 1966, pp. 25 - 48.

Mogg, J. L. 1968. Step drawdown test needs critical review; Johnson Drillers Journ., July - Aug., 1968, pp. 3 - 11.

Nielsen, G. L., 1969. Edson Aquifer testing program, Edson, Alberta; Alta. Dept. of Agriculture. Bull., 69 pp.

Sheahan, N. T., 1971. Type-curve solution of step-drawdown test; Groundwater, vol. 9, No. 1, pp. 25 - 29.

APPENDIX

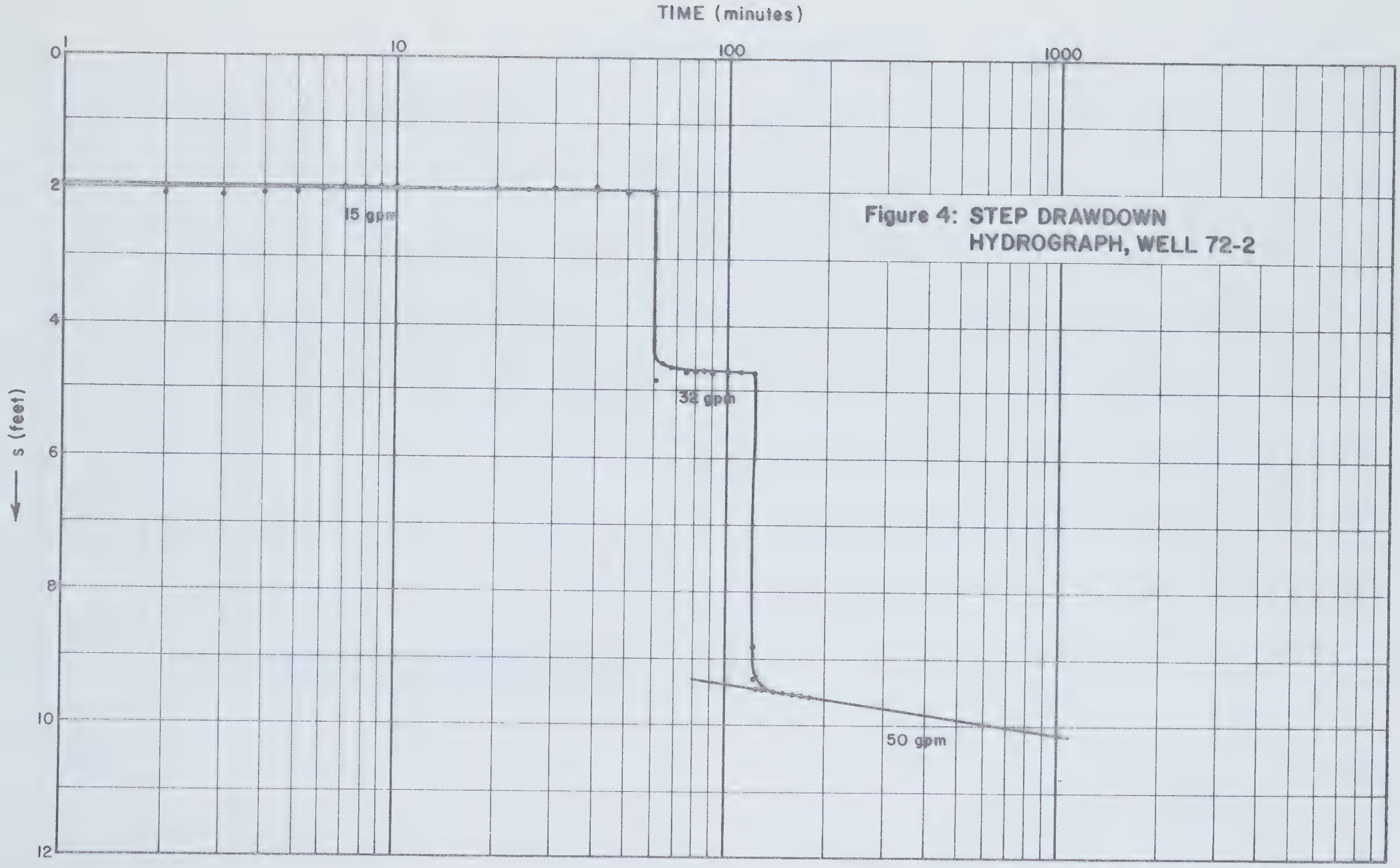


Figure 4: STEP DRAWDOWN HYDROGRAPH, WELL 72-2

WEST EDSON, LSD 4-16-53-17-W5. April 25, 1971.

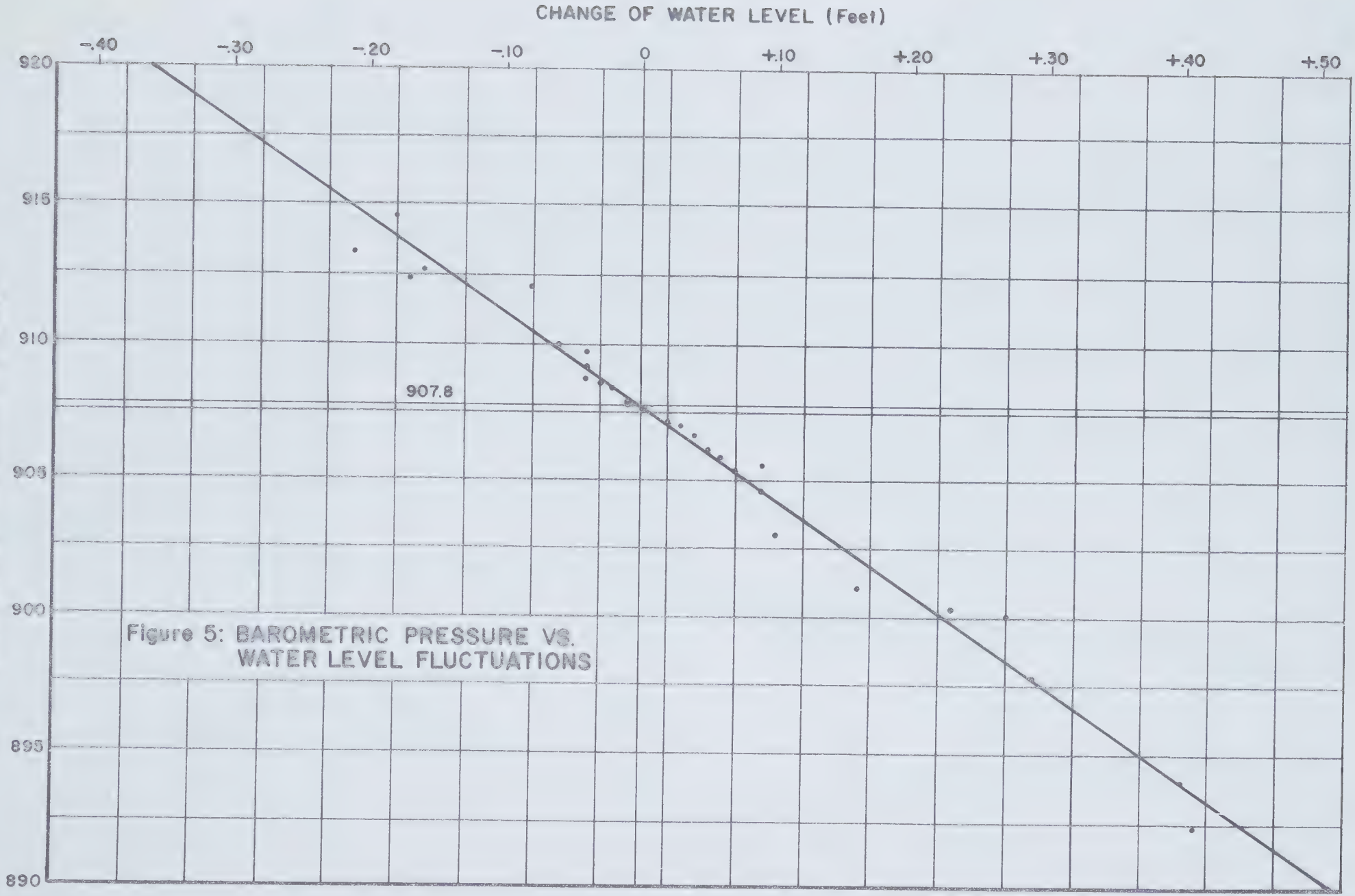


Figure 5: BAROMETRIC PRESSURE VS. WATER LEVEL FLUCTUATIONS

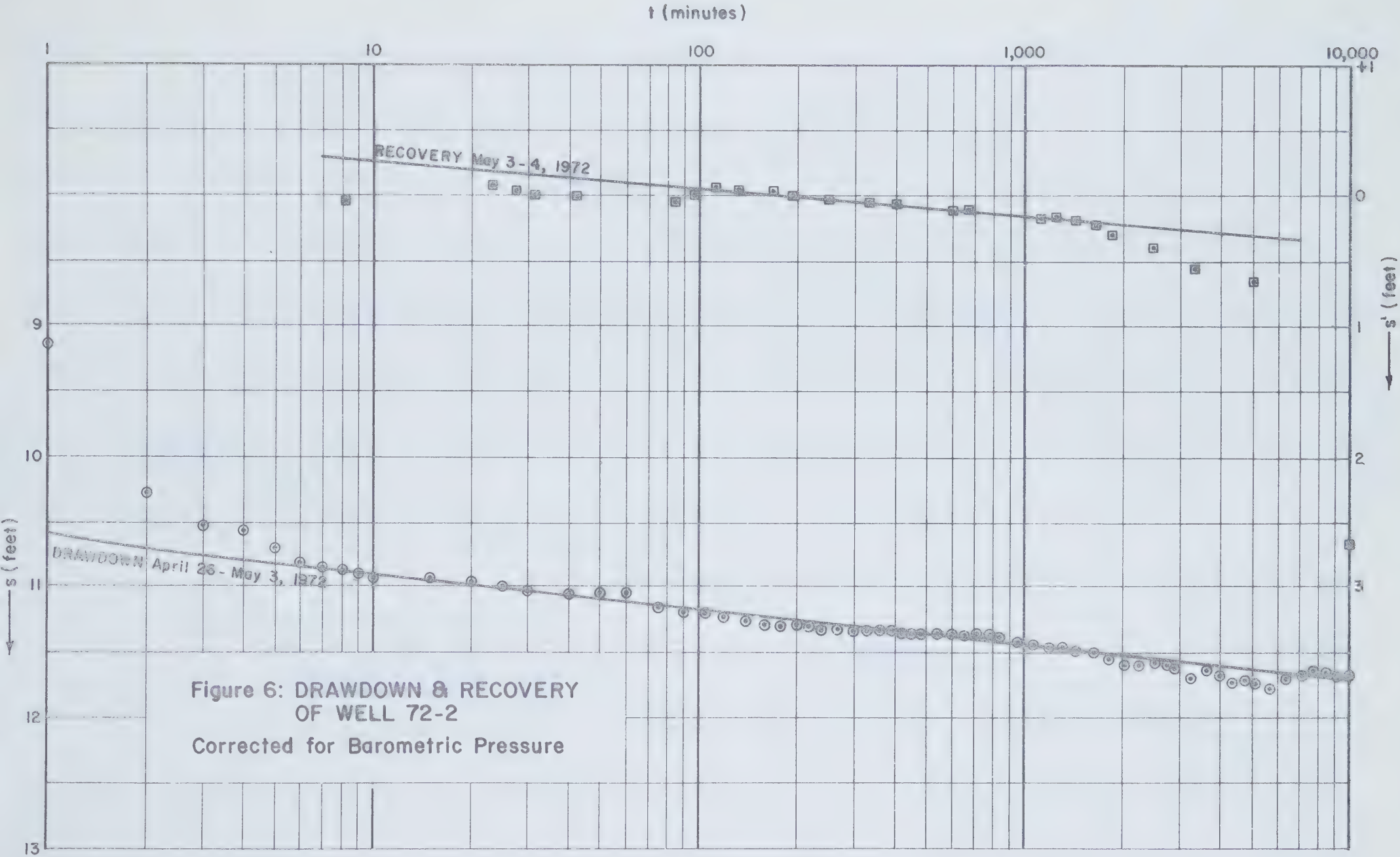


Figure 6: DRAWDOWN & RECOVERY OF WELL 72-2

Corrected for Barometric Pressure

WEST EDSON, LSD 4-16-53-17-W5

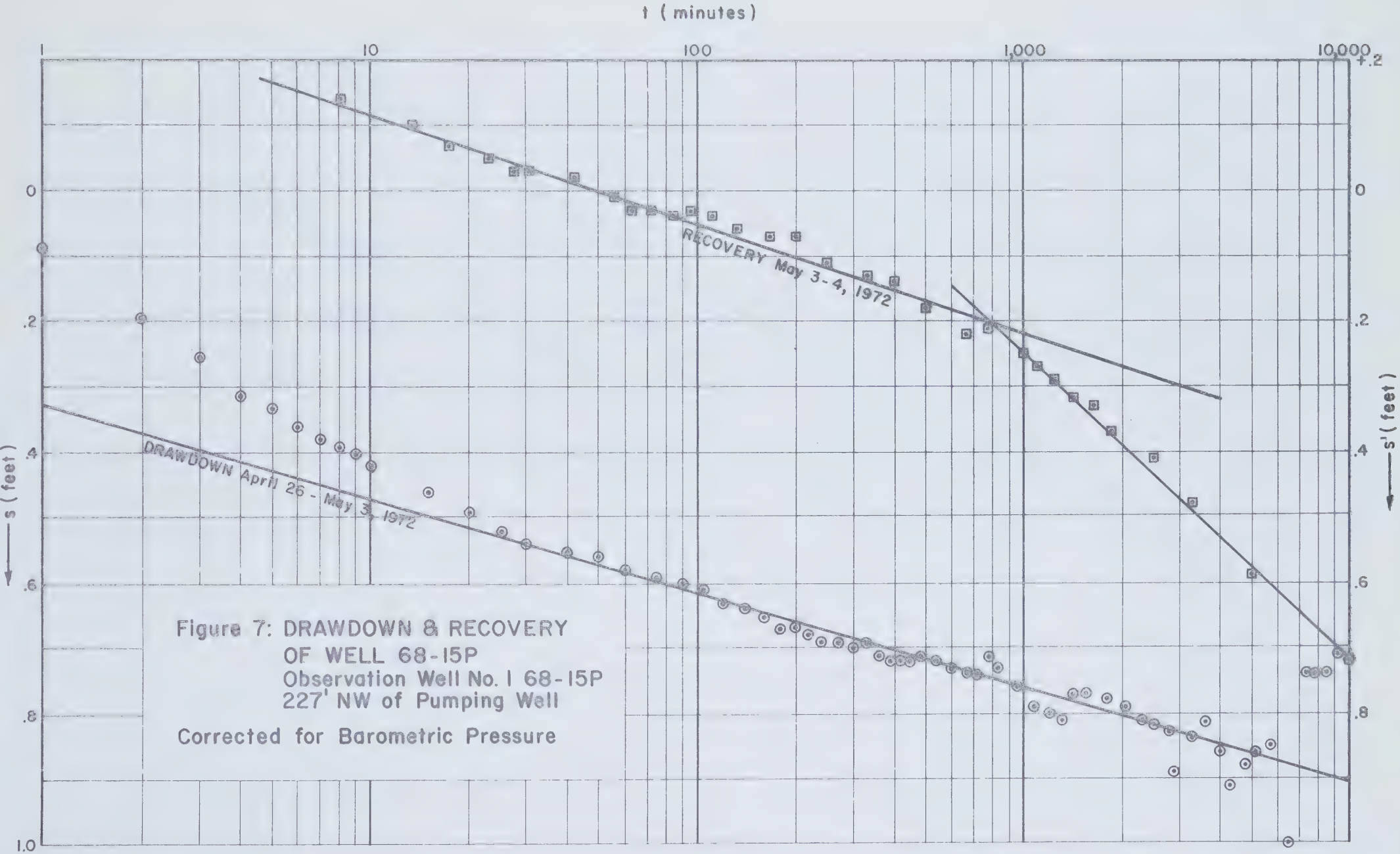


Figure 7: DRAWDOWN & RECOVERY
OF WELL 68-15P
Observation Well No. 1 68-15P
227' NW of Pumping Well

Corrected for Barometric Pressure

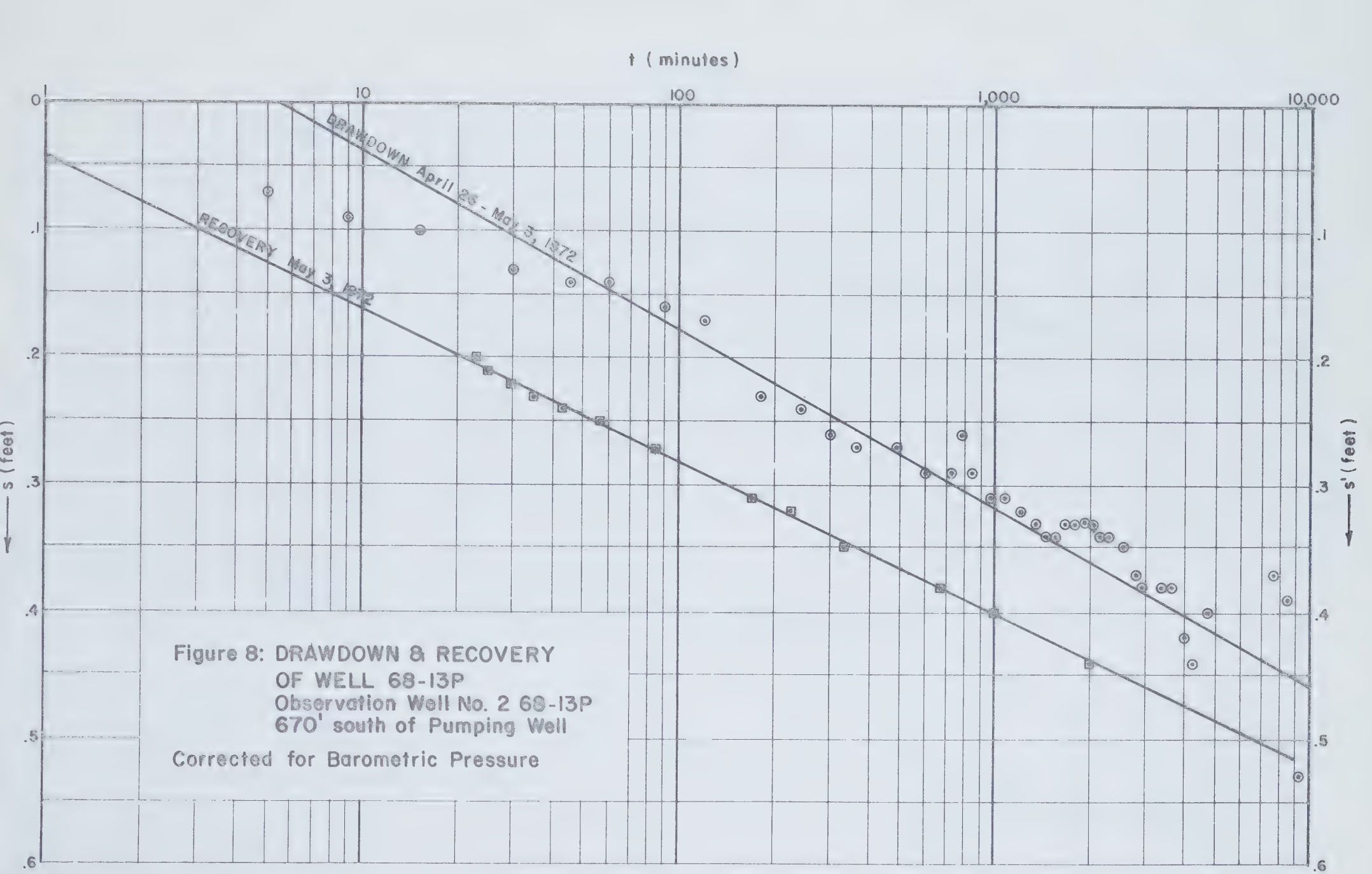


Figure 8: DRAWDOWN & RECOVERY
OF WELL 68-13P
Observation Well No. 2 68-13P
670' south of Pumping Well

Corrected for Barometric Pressure

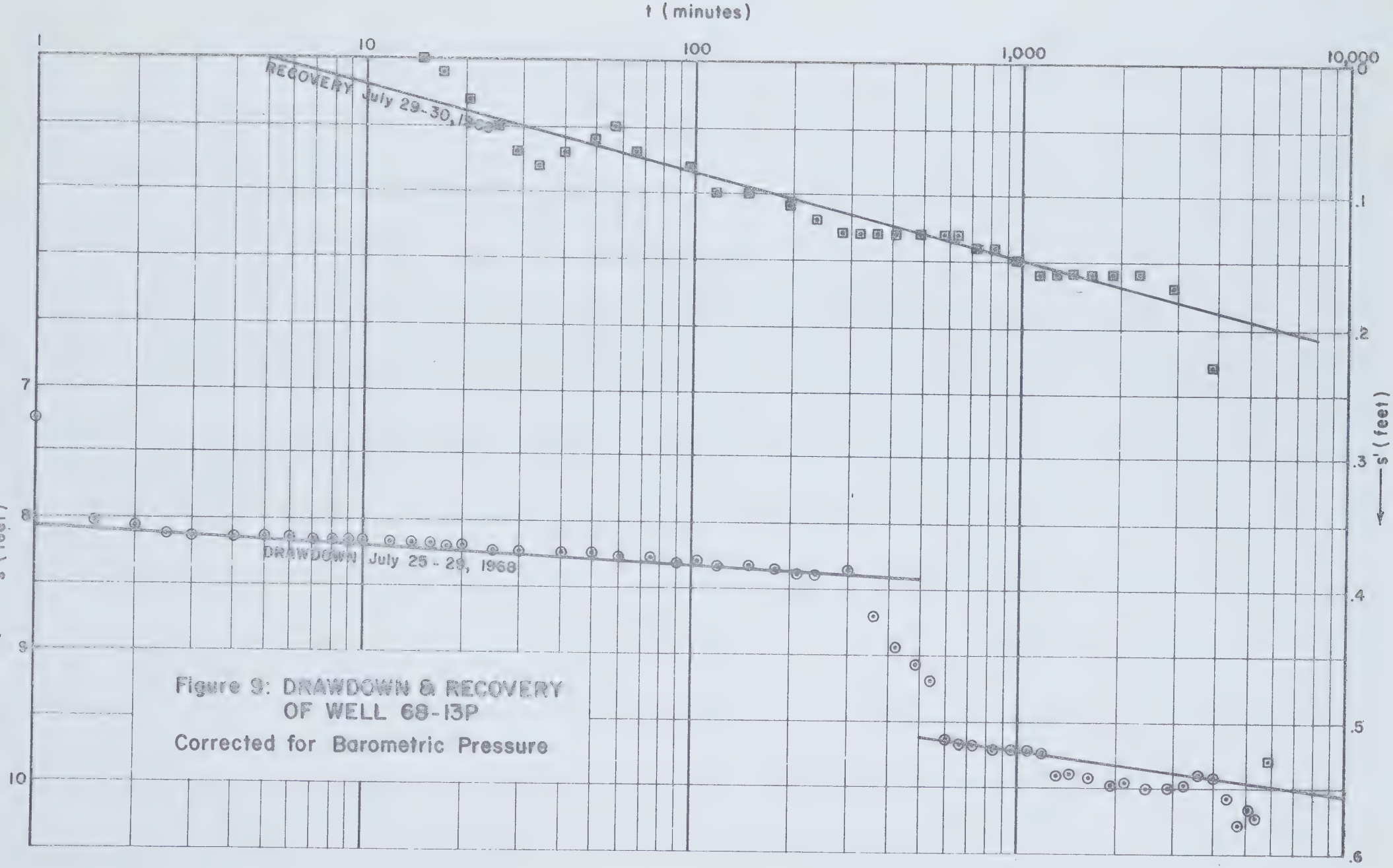


Figure 9: DRAWDOWN & RECOVERY OF WELL 68-13P

Corrected for Barometric Pressure

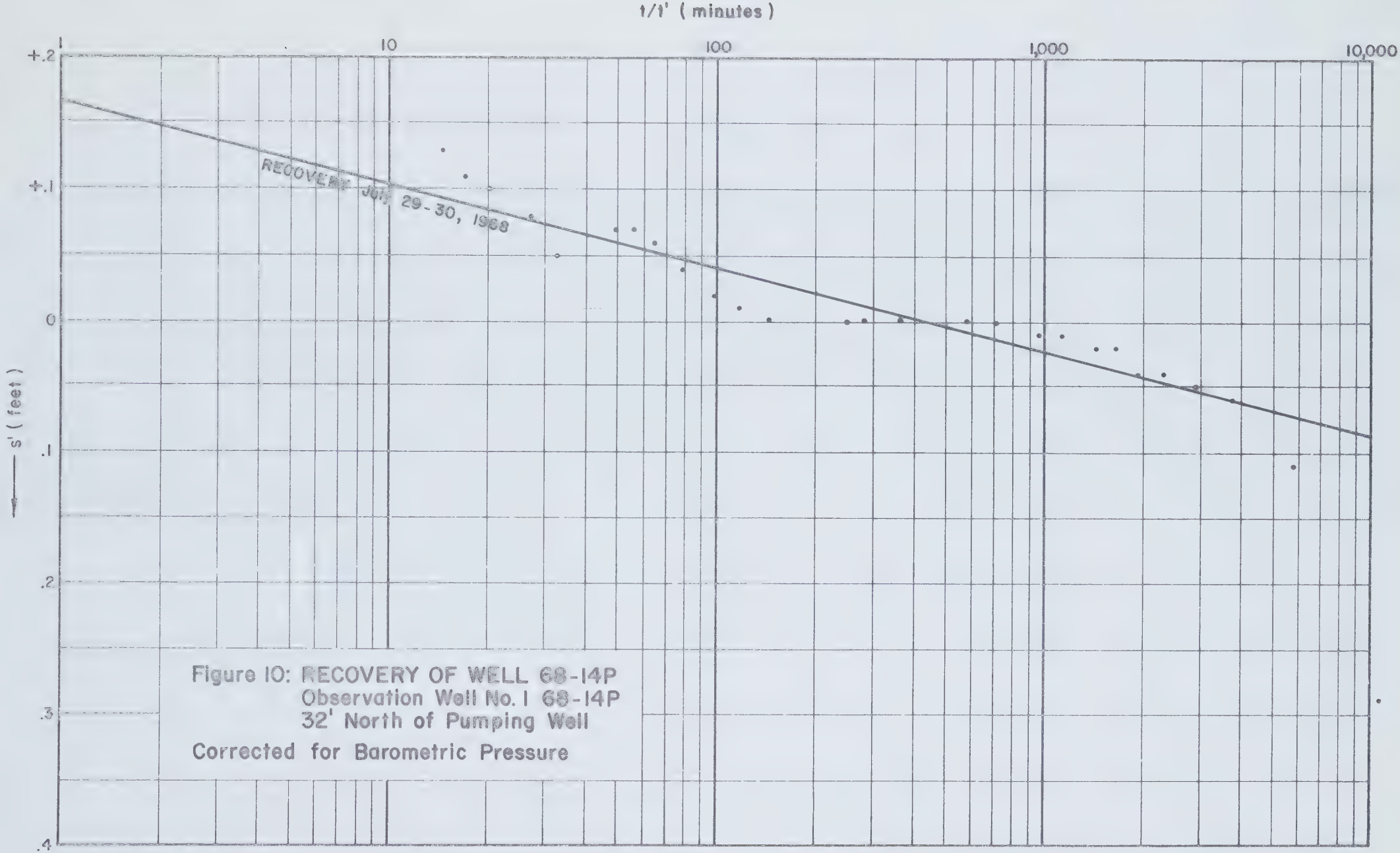


Figure 10: RECOVERY OF WELL 68-14P
Observation Well No. 1 68-14P
32' North of Pumping Well
Corrected for Barometric Pressure

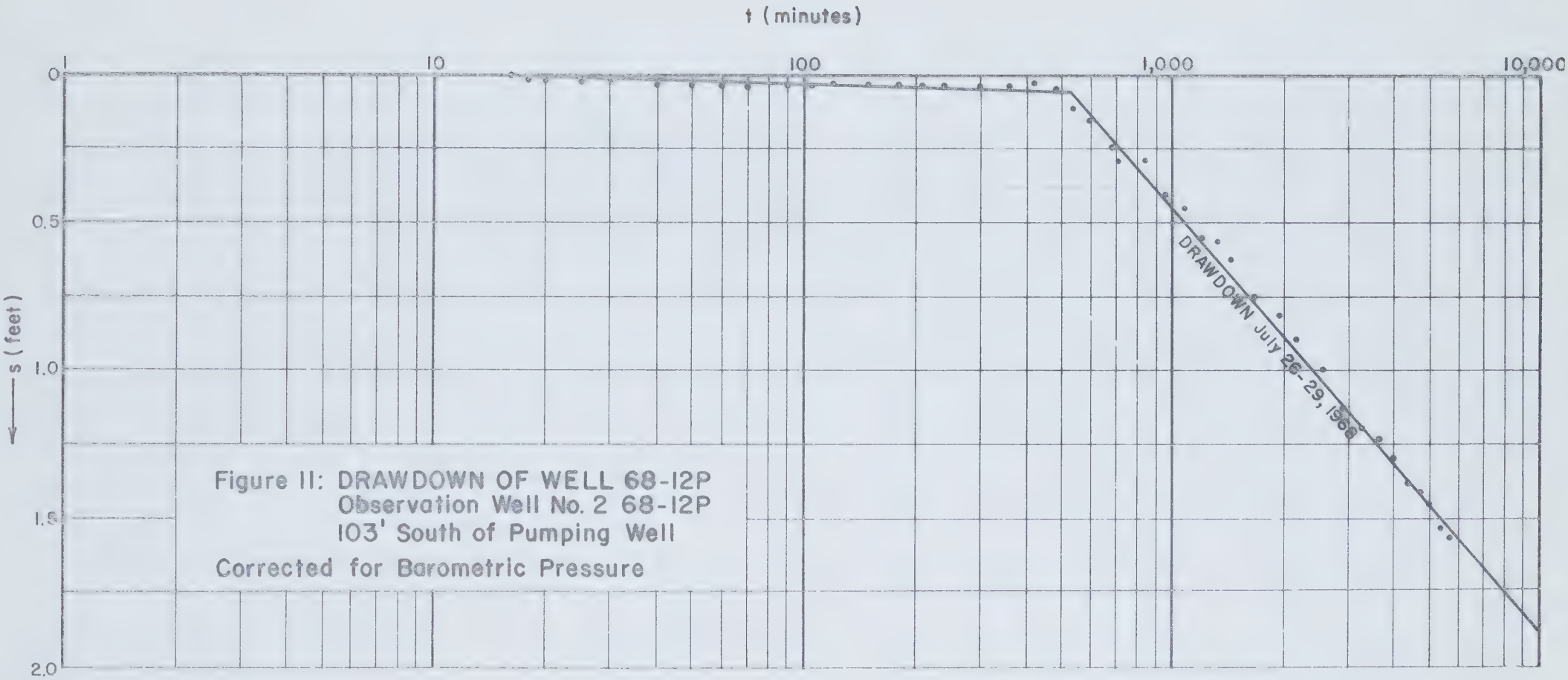


Figure 11: DRAWDOWN OF WELL 68-12P
Observation Well No. 2 68-12P
103' South of Pumping Well
Corrected for Barometric Pressure

WEST EDSON, LSD 13-9-53-17-W5

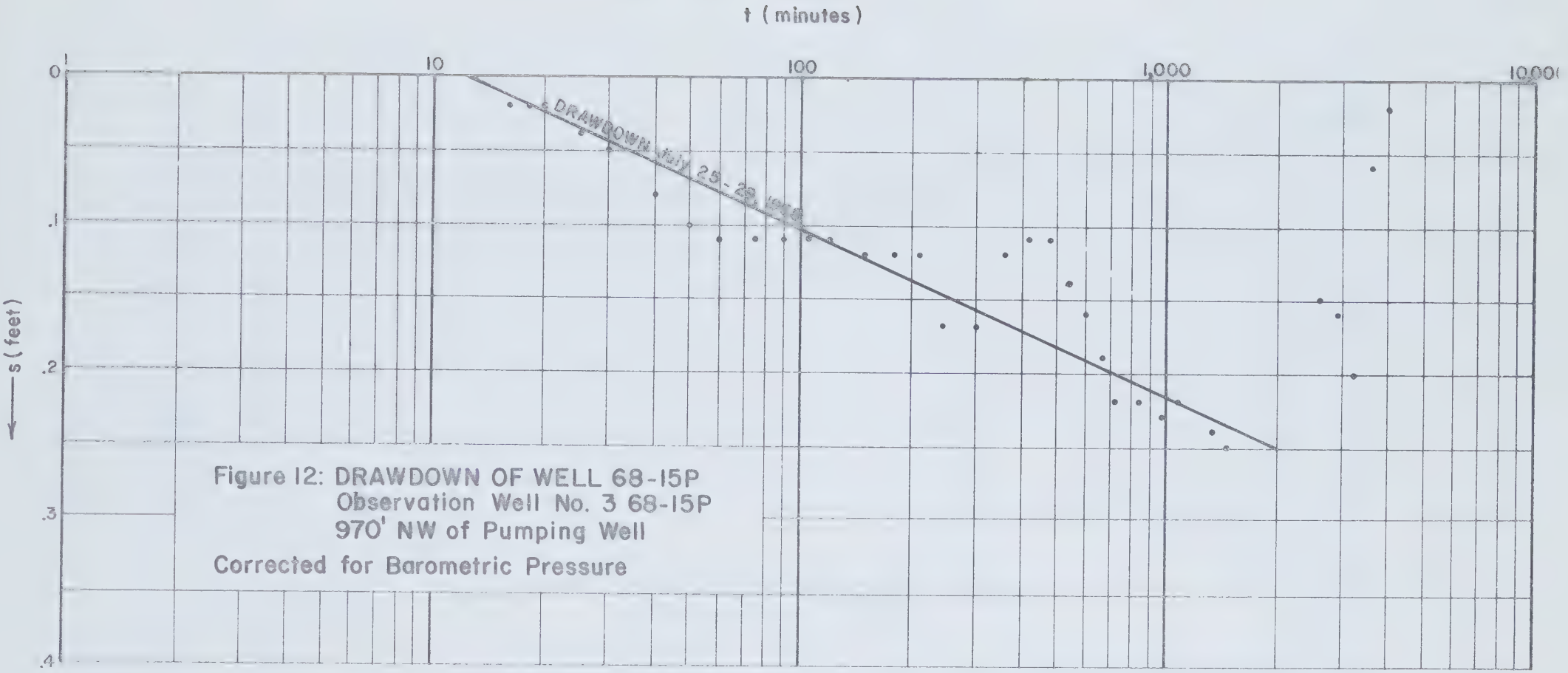
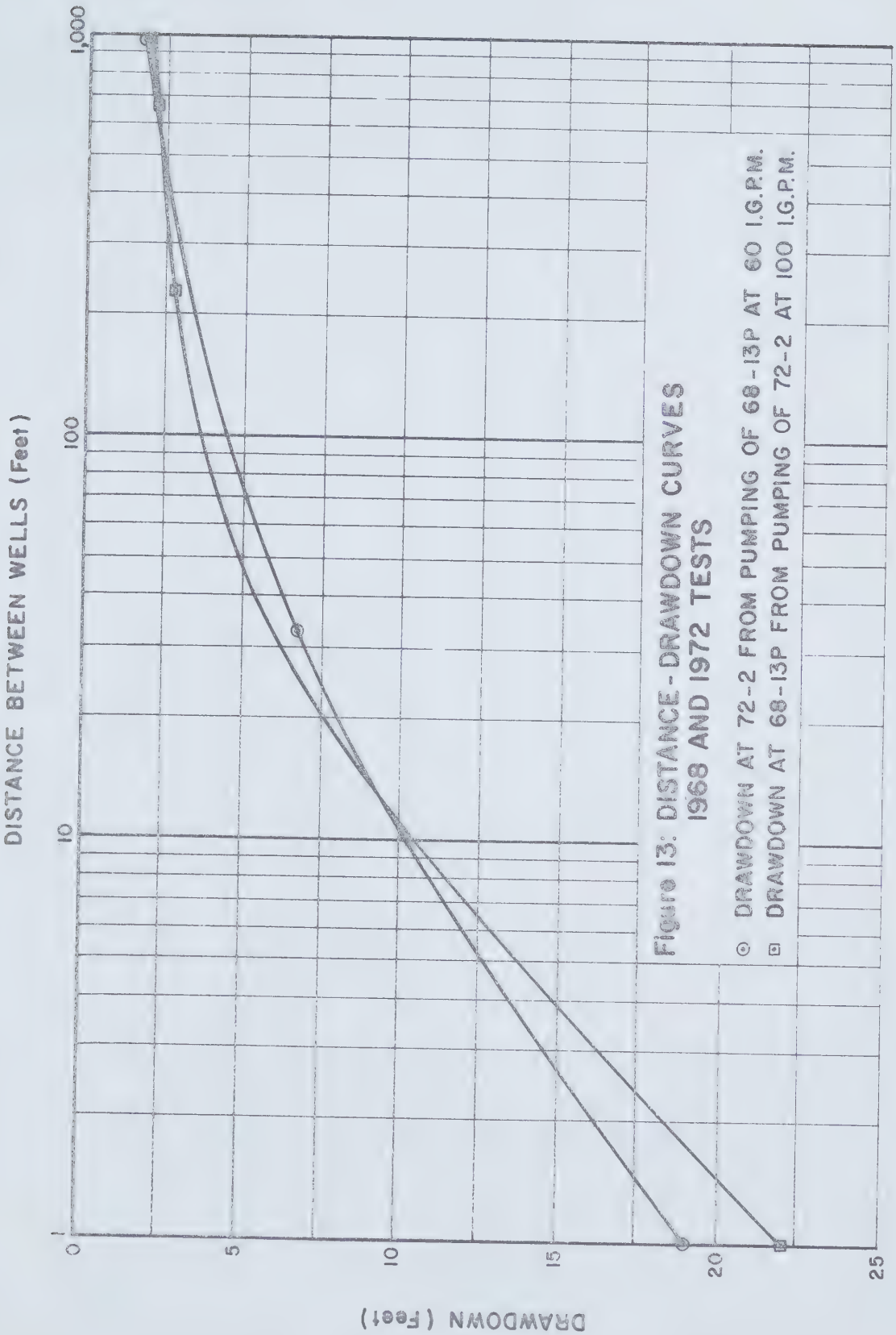


Figure 12: DRAWDOWN OF WELL 68-15P
Observation Well No. 3 68-15P
970' NW of Pumping Well
Corrected for Barometric Pressure

WEST EDSON, LSD 1-17-53-17-W5


DISTANCE BETWEEN WELLS (Feet)
1
10
100
1,000
0
5
10
15
20
25
DRAWDOWN (Feet)
Figure 13: DISTANCE-DRAWDOWN CURVES
1968 AND 1972 TESTS
⊙ DRAWDOWN AT 72-2 FROM PUMPING OF 68-13P AT 60 I.G.P.M.
⊡ DRAWDOWN AT 68-13P FROM PUMPING OF 72-2 AT 100 I.G.P.M.

SOILS, GEOLOGY AND GROUNDWATER BRANCH

Water Level Measurements (field)

Well No. 72-2 Test conducted by: G. Nielsen Measured by: Paul Baerg

Location of project West Edson Well location: Lsd. or 1/4 4 Sec. 16 Tp. 53 R. 17 Mer. W. 5

Status Pumping (pumping or observation well) R = — (distance from pumping well in feet and direction) Date April 25/72 Page 1

Step Drawdown Test

Date	Time hrs. & mins.	Elapsed time in mins.	Tape Reading at: Meas. Point	Tape Reading at: Water level	Depth to water in feet	Draw-down in feet	Q = discharge gals/min		Remarks (i.e. pumping rate, water temp., static level, etc.)
Apr. 25	1:00 PM	0			90.50	0	15		Static Level
		1			92.40	1.90			
		2			92.55	2.05			
		3			92.58	2.08			
		4			92.56	2.06	15		
		5			92.55	2.05			
		6			92.48	1.98			
		7			92.46	1.96			
		8			92.46	1.96			
		9			92.48	1.98			
		10			92.48	1.98			
		15			92.50	2.00			
		20			92.48	1.98			
		25			92.50	2.00	15		
	1:30	30			92.50	2.00	15		
		40			92.46	1.96			Train passing by 92.49' (1.99')
		50			92.53	2.03			45 sec. later.
	2:00	60			92.51	2.01	15		
		61			96.35	5.85	32		
		62			96.10	5.60			
		63			96.10	5.60			
		64			96.10	5.60	32		
		65			96.10	5.60			
		66			--	--			
		67			96.10	5.60			
		68			96.15	5.65			
	2:09	69			96.15	5.65			

ALBERTA DEPARTMENT OF THE ENVIRONMENT
WATER RESOURCES DIVISION
SOILS, GEOLOGY AND GROUNDWATER BRANCH

Water Level Measurements (field)
Well No. 72-2 Test conducted by: G.L. Nielsen Measured by: Paul Baerg
Location of project West Edson Well location: Lsd. or 1/4 4 Sec. 16 Tp. 53 R. 17 Mer. W. 5
Status Pumping R = Date April 25/72 Page 2
(pumping or observation well) (distance from pumping well in feet and direction)
STEP DRAWDOWN TEST

Date	Time hrs. & mins.	Elapsed time in mins.	Tape Reading at Meas. Point	Tape Reading at Water level	Depth to water in feet	Draw-down in feet	Q = discharge gals/min		Remarks (i.e. pumping rate, water temp., static level, etc.)
	2:10	70			96.16	5.66	32		Static 90.50
		75			96.21	5.71			
		80			96.23	5.73			
		85			96.23	5.73	32		
	2:30	90			96.23	5.73			
		100			96.21	5.71			
		110			96.20	5.70			
	3:00 PM	120			96.23	5.73			
		121			99.32	8.82	50		
		122			99.79	9.29			
		123			99.86	9.36			
		124			99.91	9.41			
		125			99.93	9.43			
		126			99.95	9.45			
		128			99.96	9.46			
	3:10	130			99.96	9.46	50		
		135			99.99	9.49			
		140			100.01	9.51			
		145			100.03	9.53			
	3:30	150			100.04	9.54			
		160			100.06	9.56			
		170			100.06	9.56	50		Train approaching
	4:00 PM	180			100.07	9.57	50		

WATER RESOURCES DIVISION
SOILS, GEOLOGY AND GROUNDWATER BRANCH

Water Level Measurements (field)

Well No. 72-2 Test conducted by: G.L. NIELSEN Measured by: Paul Baerg

Location of project West Edson Well location: Lsd. or 1/4 4 Sec. 16 Tp. 53 R. 17 Mer. W. 5

Status Pumping (pumping or observation well) R = - ----- (distance from pumping well in feet and direction) Date April 26/72 Page 1

Date	Time hrs. & mins.	Elapsed time in mins.	Tape Reading at Meas. Point Corrected	Tape Reading at Water level	Depth to water in feet	Draw-down in feet	Q = discharge gals/min	B.P.	Remarks (i.e. pumping rate, water temp., static level, etc.)
Apr 26	8:00 AM	0	D.D.		88.68	-	50	907.8	Static level 88.68
		1	9.23		97.91	9.23			
		2	10.28		98.96	10.28			
		3	10.52		99.20	10.52			
		4	10.57		99.25	10.57			
		5	10.70		99.38	10.70			
		6	10.81		99.49	10.81			
		7	10.85		99.53	10.85			
		8	10.89		99.57	10.89			
		9	10.90		99.58	10.90			
	8:10	10	10.92		99.60	10.92			
		15	10.93		99.61	10.93			
		20	10.97		99.66	10.98			
		25	11.00		99.69	11.01			
	8:30	30	11.02		99.71	11.03			
		40	11.05		99.75	11.07			
		50	11.03		99.73	11.05			
	9:00	60	11.03		99.73	11.05	Rate Down	908.5	
		75	11.16		99.86	11.18			
		90	11.18		99.88	11.20			
		105	11.20		99.90	11.22			
	10:00 AM	120	11.22		99.92	11.24		908.5	
		140	11.25		99.94	11.26			
		160	11.28		99.96	11.28			
	11:00	180	11.29		99.97	11.29		907.7	
		200	11.29		99.97	11.29			Sample #1 41.6°F
		220	11:30		99.98	11.30			

WATER RESOURCES DIVISION
SOILS, GEOLOGY AND GROUNDWATER BRANCH

Water Level Measurements (field)
Well No. 72-2 Test conducted by: G. Nielsen Measured by:
Location of project West Edson Well location: Lsd. or 1/4 4 Sec. 16 Tp. 53 R. 17 Mer. W. 5
Status Pumping R = Date April 26/72 Page 2
(pumping or observation well) (distance from pumping well in feet and direction)

Date	Time hrs. & mins.	Elapsed time in mins.	Tape Reading at Meas. Point	Tape Reading at Water level	Depth to water in feet	Draw-down in feet	Q = discharge gals/min	B.P.	Remarks (i.e. pumping rate, water temp., static level, etc.)
Apr 26	12: Noon	240	11.32		100.00	11.32		907.6	Non pumping 88.68
		270	11.32		100.00	11.32			
		300	11.33		100.00	11.32		907.4	
		330	11.32		99.99	11.31			
	2:00	360	11.32		99.99	11.31		907.4	
		390	11.32		100.00	11.32			
	3:00	420	11.34		100.01	11.33		907.5	
		450	11.34		100.01	11.33			
	4:00	480	11.34		100.02	11.34		907.8	
		540	11.35		100.03	11.35		907.7	
	6:00	600	11.35		100.03	11.35		907.9	
		660	11.35		100.03	11.35		907.8	
	8:00	720	11.34		100.03	11.35		908.1	
		780	11.35		100.08	11.40		909.5	
	10:00	840	11.38		100.10	11.42		909.1	
Apr 27	Midnight	960	11.41		100.13	11.45		908.8	
	2:00 AM	1080	11.43		100.15	11.47		908.9	
	4:00	1200	11;47		100:18	11:50		908.5	
	6:00	1320	11.48		100.19	11.51		908.4	
	8:00	1440	11.49		100.19	11.51		908.2	
	10.00	1560	11.50		100.19	11.51		908.1	
	2:00 PM	1800	11.54		100.19	11.51		906.8	
	6:00 PM	2040	11.60		100.19	11.51		904.3	
	10:00 PM	2280	11.59		100.11	11.43		902.1	
Apr 28	2:00 AM	2520	11.57		100.04	11.36		900.4	
	6:00 AM	2760	11.60		99.99	11.31		897.8	
	10:00 AM	2900	11.62		99.90	11.22		894.0	

WATER RESOURCES DIVISION
SOILS, GEOLOGY AND GROUNDWATER BRANCH

Water Level Measurements (field)

Well No. 72-2 Test conducted by: G.L. Nielsen Measured by: P. Baerg

Location of project West Edson Well location: Lsd. or 1/4 4 Sec. 16 Tp. 53 R. 17 Mer. W 5

Status Pumping (pumping or observation well) R = — (distance from pumping well in feet and direction) Date Apr. 28/72 Page 3

Date	Time hrs. & mins.	Elapsed time in mins.	Tape Reading at Meas. Point	Tape Reading at Water level	Depth to water in feet	Draw-down in feet	Q = discharge gals/min	B.P.	Remarks (i.e. pumping rate, water temp., static level, etc.)
	4: PM	3260	11.69		99.92	11.24		892.3	Non pumping 88.68
	10:00 PM	3620	11.63		100.09	11.41		900.1	
Apr 29	4: AM	3980	11.66		100.28	11.60		905.7	
	10:00 AM	4340	11.72		100.42	11.74		908.3	
	6:00 PM	4820	11.71		100.45	11.77		909.8	
Apr 30	2:00 AM	5240	11.73		100.55	11.87		912.4	Daylight saving time
	10:00 AM	5720	11.77		100.62	11.94		913.4	
	10:00 PM	6440	11.70		100.53	11.85		912.7	
May 1	10:00 AM	7160	11.67		100.55	11.87		914.7	
	8:00 PM	7760	11.63		100.44	11.76		912.1	
May 2	8:00 AM	8480	11.65		100.43	11.75		910.9	
	8:00 PM	9200	11.67		100.37	11.71		909.1	
May 3	8:00 AM	9920	11.67		100.40	11.74		910.0	

WATER RESOURCES DIVISION
SOILS, GEOLOGY AND GROUNDWATER BRANCH

Water Level Measurements (field)
Well No. 72-2 Test conducted by: G. Nielsen Measured by:
Location of project West Edson Well location: Lsd. or 1/4 4 Sec. 16 Tp. 53 R. 17 Mer. W. 5
Status Pumping (pumping or observation well) R = ---- (distance from pumping well in feet and direction) Date May 3/72 Page 1

Recovery

Date	Time hrs. & mins.	Elapsed time in mins.	Tape Reading at Meas. Point t	Tape Reading at Water level t/t	Depth to water in feet	Draw-down in feet	B.P. Q = discharge gals/min	Corrected D.D.	Remarks (i.e. pumping rate, water temp., static level, etc.)
May 3	8:00 AM	0	9920	-	100.40	11.74	910.0	11.67	Static - 88.68
	01	1	9921	9921	91.51	2.83		2.76	
	02	2	9922	4961	89.47	0.73		.66	
	03	3	9923	3308	89.30	0.62		.55	
	04	4	9924	2481	89.15	0.47		.40	
	05	5	9925	1985	89.05	0.37		.30	
	06	6	9926	1654	88.97	0.29		.22	
	07	7	9927	1418	88.94	0.26		.19	
	08	8	9928	1241	88.93	0.25		.18	
	09	9	9929	1103	88.92	0.24		.17	
	10	10	9930	993	88.91	0.23		.16	
	15	15	9935	662.3	88.86	0.18		.11	
	20	20	9940	497	88.86	0.18		.11	
	25	25	9945	398	88.81	0.13		.06	
	30	30	9950	331.7	88.80	0.12		.05	
	40	40	9960	249	88.77	0.09		.02	
	50	50	9970	199.4	88.75	0.07		.00	
	9:00	60	9980	166.3	88.73	.05		+.02	
	15	75	9995	130.6	88.71	.03	910.1	+.03	
	30	90	10,010	111.2	88.66	+.02		+.06	
	45	105	10,025	95.5	88.73	.05		.00	
	10:00	120	10,040	83.6	88.66	+.02	909.8	.03	
	30	140	10,060	71.8	88.70	.02			
	40	160	10,080	63.0		-			
	11:00	180	10,100	56.1		-	909.3		
	30	210	10,130	48.2		-			
	12:00 Noon	240	10,160	42.3	88.64	+.04	909.0	.00	

DEPARTMENT OF THE ENVIRONMENT
WATER RESOURCES DIVISION
SOILS, GEOLOGY AND GROUNDWATER BRANCH

Water Level Measurements (field)

Well No. 72-2 Test conducted by: G. Nielsen Measured by: G. Nielsen

Location of project West Edson Well location: Lsd. or 1/4 4 Sec. 16 Tp. 53 R. 17 Mer. W. 5

Status Pumping R = Date May 3/72 Page 2

(pumping or observation well) (distance from pumping well in feet and direction)

Recovery

Date	Time hrs. & mins.	Elapsed time in mins.	Tape Reading at Meas. Point t	Tape Reading at Water Level t/	Depth to water in feet	Draw-down in feet	B.P. Q = discharge gals/min	Corrected D.D.	Remarks (i.e. pumping rate, water temp., static level, etc.)
May 3	1:30PM	330	10,250	31.1	88.65	+.03	908.6	.00	
	2:15	375	10,295	21.4	88.63	+0.05		+.04	
	3:30	450	10,370	23	88.58	+ .10		+.09	
May 4	7:25AM	1405	11,325	8.1	88.60	+ .08	911.7	-.04	

Form: WR-H-3

DEPARTMENT OF THE ENVIRONMENT
WATER RESOURCES DIVISION
SOILS, GEOLOGY AND GROUNDWATER BRANCH

Water Level Measurements (field)
Well No. 68-15P
Test conducted by: G. Nielsen Measured by: G. Nielsen
Location of project West Edson Well location: Lsd. or 1/4 4 Sec. 17 Tp. 53 R. 17 Mer. W. 5
Status Observation #1 R = 227' N.W. Date Apr 26/72 Page 1
(pumping or observation well) (distance from pumping well in feet and direction)

Date	Time hrs. & mins.	Elapsed time in mins.	Tape Reading at: Meas. Point	Tape Reading at: Water level	Depth to water in feet	Corrected Draw-down in feet	Q = discharge gals/min	B.P.	Remarks (i.e. pumping rate, water temp., static level, etc.)
Apr 26	8:00 AM	0	0		95.33	0	50	907.8	Static level
		1	.09			.09			
		2	.19			.19			
		3	.25			.25			
		4	.31			.31			
		5	.33			.33			
		6	.36			.36			
		7	.38			.38			
		8	.39			.39			
		9	.40			.40			
	8:10	10	.42			.42			
		15	.46			.46			
		20	.49			.49			
		25	.52			.52			
	8:30	30	.54			.54			
		40	.55			.55			
		50	.56			.56			
	9:00	60	.58			.59		908.5	
		75	.59			.61			
		90	.60			.62			
		105	.61			.63			
	10:00	120	.63			.65		908.5	
		140	.64			.66			
		160	.65			.66			Fluctuations from trains 0.03'
	11:00 AM	180	.67			.67		907.7	
		200	.67			.67			
		220	.68			.68			

WATER RESOURCES DIVISION
SOILS, GEOLOGY AND GROUNDWATER BRANCH

Water Level Measurements (field)
Well No. 68-15P
Location of project West Edson
Status Observation #1 (pumping or observation well)
Test conducted by: G.L. Nielsen
Measured by: G. Nielsen
Well location: Lsd. or 1/4 4 Sec. 17 Tp. 53 R. 17 Mer. W. 5
R = 227' N.W. (distance from pumping well in feet and direction)
Date Apr 26/72 Page 2

Date	Time hrs. & mins.	Elapsed time in mins.	Tape Reading at Meas. Point	Tape Reading at Water level	Depth to water in feet	Draw-down in feet	Q = discharge gals/min	B.P.	Remarks (i.e. pumping rate, water temp., static level, etc.)
			Corrected DD						
Apr 26	12:00 Noon	240	.69		.69			907.6	
		270	.69		.69				
		300	.70		.69			907.4	
		330	.69		.69				
	2:00 PM	360	.71		.70			907.4	
		390	.72		.71				
	3:00	420	.72		.71			907.5	
		450	.72		.71				
	4:00	480	.71		.71			907.8	
		540	.72		.72			907.7	
	6:00	600	.73		.73			907.9	
		660	.74		.74			907.8	
	8:00	720	.74		.75			908.1	
		780	.71		.76			909.5	
	10:00	840	.73		.77			909.1	
Apr 27	Midnight	960	.76		.79			908.8	
	2:00 AM	1080	.79		.83			908.9	
	4:00	1200	.80		.83			908.5	
	6:00	1320	.81		.83			908.4	
	8:00	1440	.77		.78			908.2	
	10:00	1560	.77		.78			908.1	
	2:00 PM	1800	.78		.75			906.8	
	6:00 PM	2040	.79		.69			904.3	
	10:00 PM	2280	.81		.65			902.1	
Apr 28	2:00 AM	2520	.82		.62			900.4	
	6:00 AM	2760	.83		95.54			897.8	
	10:00 AM	2900	.89		95.49			894.0	

DEPARTMENT OF THE ENVIRONMENT
WATER RESOURCES DIVISION
SOILS, GEOLOGY AND GROUNDWATER BRANCH

Water Level Measurements (field)

Well No. 58-15P Test conducted by: G.L. Nielsen Measured by: Paul Baerg

Location of project West Edson Well location: Lsd. or 1/4 4 Sec. 17 Tp. 53 R. 17 Mer. W. 5

Status Observation Well #1 (pumping or observation well) R = 227' N.W. (distance from pumping well in feet and direction) Date Apr 28/72 Page 3

Date	Time hrs. & mins.	Elapsed time in mins.	Tape Reading at Meas. point	Tape Reading at Water level (Corrected)	Depth to water in feet	Draw-down in feet	Q = discharge gals/min	B.P.	Remarks (i.e. pumping rate, water temp., static level, etc.)
	4:00 PM	3260	.84		95.40			892.3	
	10:00 PM	3620	.81		95.59			900.1	
Apr 29	4:00 AM	3980	.86		95.80			905.7	
	10:00	4340	.91		95.92			908.3	
	6:00 PM	4820	.88		95.94			909.8	
Apr 30	2:00 AM	5240	.86		96.00			912.4	
	10:00	5720	.85		96.02			913.4	
	10:00 PM	6440	1.00		96.15			912.7	
May 1	10:00 AM	7160	.74		95.95			914.7	
	8:00 PM	7760	.74		95.87			912.1	
May 2	8:00 AM	8430	.74		95.83			910.9	
	8:00 PM	9200	.71		.75			909.1	
May 3	8:00 AM	9920	.72		.79			910.0	

Form: WR-H-3

DEPARTMENT OF THE ENVIRONMENT
WATER RESOURCES DIVISION
SOILS, GEOLOGY AND GROUNDWATER BRANCH

Water Level Measurements (field)

Well No. 68-15P

Test conducted by: G. Nielsen Measured by: G.L. Nielsen

Location of project West Edson Well location: Lsd. or 1/4 1 Sec. 17 Tp. 53 R. 17 Mer. W. 5

Status Observation #1 (pumping or observation well) R = 227' N.W. (distance from pumping well in feet and direction)

Date MAY 3/72 Page 1

Recovery

Date	Time hrs. & mins.	Elapsed time in mins.	Tape Reading at Meas. Point t	Tape Reading at Water Level t/t'	Depth to water in feet	Corrected Draw-down in feet	Q = discharge gals/min	B.P.	Remarks (i.e. pumping rate, water temp., static level, etc.)
May 3	8:00 AM	0	9920	-	.79			910.0	
	01	1	9921	9921	.79	.72			
	02	2	9922	4961	.66	.59			
	03	3	9923	3308	.55	.48			
	04	4	9924	2481	.48	.41			
	05	5	9925	1985	.44	.37			
	06	6	9926	1654	.40	.33			
	07	7	9927	1418	.39	.32			
	08	8	9928	1241	.36	.29			
	09	9	9929	1103	.34	.27			
	10	10	9930	993	.32	.25			
	15	15	9935	662	.29	.22			
	20	20	9940	497	.25	.18			
	25	25	9945	398	.21	.14			
	30	30	9950	332	.20	.13			
	40	40	9960	249	.18	.11			
	50	50	9970	199	.14	.07			
	9:00	60	9980	166	.14	.07		910.1	
	15	75	9995	131	.13	.06			
	30	90	10,010	111	.11	.04			
	45	105	10,025	95	.09	.03			
	10:00	120	10,040	84	.10	.04		909.8	
	20	140	10,060	72	.08	.03			
	40	160	10,080	63	.08	.03			
	11:00	180	10,100	56	.06	.01		909.3	
	11:30	210	10,130	48	-	-			
	12:00 Noon	240	10,160	42	.02	+.02		909.0	

DEPARTMENT OF THE ENVIRONMENT
WATER RESOURCES DIVISION
SOILS, GEOLOGY AND GROUNDWATER BRANCH

Water Level Measurements (field)
Well No. 68- 15F
Location of project West Edson
Status Observation #1 (pumping or observation well)
Test conducted by: G.L. Nielsen
Well location: Lsd. or 1/4 1 Sec. 17 Tp. 53 R. 17 Mer. W. 5
R = (distance from pumping well in feet and direction)
Measured by: G.L. Nielsen
Date
Page 2

Date	Time hrs. & mins.	Elapsed time in mins.	Tape Reading at Meas. Point t	Tape Reading at Water level t/	Depth to water t' in feet	Draw-down in feet	Corrected Q discharge gals/min	B.P.	Remarks (i.e. pumping rate, water temp., static level, etc.)
	1:25 PM	325	10,250	31	.00	+.03	+.03	908.6	
	2:15	375	10,295	27.4		+.02	+.03	907.9	
	3:30	450	10,370	23.0		+.04	+.05	908.1	
	6:00	600	10,520	17.5		+.02	+.07	909.3	B.P. 10 PM - 910.0
	9:15	795	10,715	13.5		+.04	+.10	909.9	11 910.1
May 4	7:30 AM	1405	11,325	8.1		+.02	+.14	911.7	midnight 910.1
									2 910.7
									4 910.9
									6 911.0

DEPARTMENT OF THE ENVIRONMENT
WATER RESOURCES DIVISION
SOILS, GEOLOGY AND GROUNDWATER BRANCH

Water Level Measurements (field)

Well No. 68-13P Test conducted by: G. Nielsen Measured by: Recorder

Location of project Edson Well location: Lsd. or 1/4 13 Sec. 9 Tp. 53 R. 17 Mer. W. 5

Status Observation #2 (pumping or observation well) R = 670' South (distance from pumping well in feet and direction) Date Apr 26/72 Page 1

Date	Time hrs. & mins.	Elapsed time in mins.	Tape Reading at: Meas. Point	Tape Reading at: Water level	Depth to water in feet	Corrected Draw-down in feet	Q = discharge gals/min	B.P.	Remarks (i.e. pumping rate, water temp., static level, etc.)
Apr 26	8:00 AM	0			83.70	0		907.8	
	15	15	.10			.10			
	30	30	.13			.14			
	45	45	.14			.16			
	9:00	60	.14			.17		908.5	
	9:30	90	.16			.19			
	10:00	120	.17			.20		908.5	
	11.00	180	.23			.23		907.7	
	12:00	240	.24			.24		907.6	
	1:00PM	300	.26			.25		907.4	
	2:00	360	.27			.26		907.4	
	4:00	480	.27			.27		907.8	
	6:00	600	.29			.29		907.9	
	8:00	720	.29			.30		908.1	
	9:00	780	.26			.31		909.5	
	10:00	840	.29			.33		909.1	
	12Midnight	960	.31			.34		908.8	
Apr 27	2:00 AM	1080	.31			.35		908.9	
	4:00	1200	.32			.35		908.5	
	6:00	1320	.33			.36		908.4	
	8:00	1440	.34			.36		908.2	
	10:00	1560	.34			.35		908.1	
	12:00 Noon	1680	.33			.32			
	2:00 PM	1800	.33			.29		906.8	
	4:00	1920	.33			.27			
	6:00	2040	.33			.24		904.3	
	8:00	2160	.34			.21			

DEPARTMENT OF THE ENVIRONMENT
WATER RESOURCES DIVISION
SOILS, GEOLOGY AND GROUNDWATER BRANCH

Water Level Measurements (field)
Well No. 68-13P Test conducted by: G. Nielsen Measured by: Recorder
Location of project Edson Well location: Lsd. or 1/4 13 Sec. 9 Tp. 53 R. 17 Mer. W. 5
Status Observation #2 R = 670' S. Date Apr 27/72 Page 2
(pumping or observation well) (distance from pumping well in feet and direction)

Date	Time hrs. & mins.	Elapsed time in mins.	Tape Reading at: Meas. Point	Tape Reading at: Water level	Depth to water in feet	Corrected Draw-down in feet	Q = discharge gals/min	B.P.	Remarks (i.e. pumping rate, water temp., static level, etc.)
Apr 27	10:00 PM	2280	.34			.18	50	902.1	
	12 Midnight	2400				.16			
	2:00 AM	2520	.35			.14		900.4	
	4:00 AM	2640				.11			
	6:00	2760	.37			.08		897.8	
	8:00	2880	.38			.04		+896.0	894.0 10 AM
	12:00 NOON	3000	.43			.01		+893.3	
	2:00 PM	3120	.44			+.02		+893.3	892.3 4PM
	5:00 PM	3300	.44			+.01		+892.3	
	6:00	3360	.38			.01		895	
	8:00	3480	.38			.07		897	
	10:00	3600	.38			.16		900.1	
	Midnight	3720	.38			.22		902	
Apr 29	2:00 AM	3840	.41			.30		904	
	4:00 AM	3960	.42			.36		905.7	
	6:00 AM	4080	.44			.41		906.7	
	8:00 AM	4200	.44			.44		907.7	908.3 10 AM
	12:00 Noon	4320	.42			.45		908.7	
	6:00 PM	4680	.40			.46		909.8	
	9:00 PM	4840				.47			
Apr 30	12:00 Noon	5780				1.05			9134. 10 AM
	6:00 PM	6140				.97			
	Midnight	6500				.95		+913.7	
May 1	4:00 AM	6740				.96			
	8:00 AM	6980	.45			.60		913.2	
	2:00 PM	7220	.41			.55		912.8	
	8:00 PM	7580	.37			.50		912.1	

DEPARTMENT OF THE ENVIRONMENT
WATER RESOURCES DIVISION
SOILS, GEOLOGY AND GROUNDWATER BRANCH

Water Level Measurements (field)

Well No. 68-13 Test conducted by: G.L. Nielsen Measured by: Recorder

Location of project Edson Well location: Lsd. or 1/4 13 Sec. 9 Tp. 53 R. 17 Mer. W. 5

Status Observation #2 (pumping or observation well) R - 670' S. (distance from pumping well in feet and direction) Date Apr 27/72 Page 3

Date	Time hrs. & mins.	Elapsed time in mins.	Tape Reading at Meas. Point	Tape Reading at Water level	Depth to water in feet	Corrected Draw-down in feet	Q = discharge gals/min		Remarks (i.e. pumping rate, water temp., static level, etc.)
	Midnight	7840	-			.49		-	
May 2	8:00 AM	8480	.39		84.19	.49	50	910.9	
	8:00 PM	9200	.53		84.27	.57		909.1	
May 3	8:00 AM	9920	.48		84.25	.55		910.0	

WATER RESOURCES DIVISION
SOILS, GEOLOGY AND GROUNDWATER BRANCH

Water Level Measurements (field)
Well No. 68-13P Test conducted by: G. Nielsen Measured by: Automatic Recorder
Location of project West Edson Well location: Lsd. or 1/4 13 Sec. 9 Tp. 53 R. 17 Mer. W. 5
Status Observation Well #2 R = 670' S. Date May 3/72 Page 1
(pumping or observation well) (distance from pumping well in feet and direction)

Recovery

Date	Time hrs. & mins.	Elapsed time in mins.	Tape Reading at Meas. Point t	Tape Reading at Water level t/t'	Depth to water in feet	Draw-down in feet	Corrected Q = discharge gals/min	D.D. B.P.	Remarks (i.e. pumping rate, water temp., static level, etc.)
May 3	8:00 AM	0	9920	-	84.25	.55	.48	910.0	
	.05	5	9925	1985	84.21	.51	.44		
	10	10	9930	993	84.17	.47	.40		
	15	15	9935	662	84.15	.45	.38		
	30	30	9950	331.7	84.12	.42	.35		
	45	45	9965	222	84.09	.39	.32		
	9:00	60	9980	166	84.08	.38	.31	910.1	
	10:00	120	10,040	84	84.03	.33	.27	909.8	
	11:00	180	10,100	56.2	84.00	.30	.25	909.3	
	12:00 Noon	240	10,160	42.3	83.98	.28	.24	909.0	
	1:00 PM	300	10,220	34	83.96	.26	.23	908.6	
	2:00	360	10,380	28.8	83.93	.23	.22	907.9	
	3:00	420	10,440	24.5	83.92	.22	.21	908.0	
	4:00	480	10,500	21.9	83.91	.21	.20(?)	?	

DEPARTMENT OF THE ENVIRONMENT
WATER RESOURCES DIVISION
SOILS, GEOLOGY AND GROUNDWATER BRANCH

Water Level Measurements (field)
Well No. 68-13P Test conducted by: Hi Rate Measured by: J. McKay
Location of project Edson Well location: Lsd. or 1/4 13 Sec. 9 Tp. 53 R. 17 Mer. W. 5
Status Pumping Well (pumping or observation well) R = - (distance from pumping well in feet and direction) Date July 25/68 Page 1

Date	Time hrs. & mins.	Elapsed time in mins.	Tape Reading at: Meas. Point	Tape Reading at: Water level	Depth to water in feet	Draw-down in feet	Q = discharge gals/min	B.P.	Remarks (i.e. pumping rate, water temp., static level, etc.)
Jul 25	8:15 AM								Static level 80.87
	9:55								
	10:00 AM	.5	88.11	7.24	7.24		30	910.5	
		1.	88.84	7.97	7.97				
		1.5	88.88	8.01	8.01				
		2	88.92	8.05	8.05				
		2.5	88.98	8.11	8.11				
		3	88.99	8.12	8.12		30		
		3.5	88.99	8.12	8.12				
		4	89.00	8.13	8.13				
		4.5	89.00	8.13	8.13				
		5	88.99	8.12	8.12		30		
		6	89.00	8.13	8.13				
		7	89.01	8.14	8.14				
		8	89.02	8.15	8.15				
		9	89.02	8.15	8.15		30		
		10	89.02	8.15	8.15				
		12	89.03	8.16	8.16				
		14	89.05	8.18	8.17				
		16	89.05	8.18	8.18		30		
		18	89.07	8.20	8.20				
		20	89.07	8.20	8.20				
		25	89.08	8.21	8.21		30		
		30	89.09	8.22	8.22				
		40	89.11	8.24	8.24				
		50	89.11	8.24	8.24		30		
	11:00 AM	60	89.14	8.27	8.27			910.5	

WATER RESOURCES DIVISION
SOILS, GEOLOGY AND GROUNDWATER BRANCH

Water Level Measurements (field)

Well No. 68-13P Test conducted by: Hi-Rate Drilling Measured by: J. McKay & L. Taylor

Location of project Edson Well location: Lsd. or 1/4 13 Sec. 9 Tp. 53 R. 17 Mer. W. 5

Status Pumping Well (pumping or observation well) R = (distance from pumping well in feet and direction) Date July 27/68 Page 2

Date	Time hrs. & mins.	Elapsed time in mins.	Tape Reading at: Meas. Point	Tape Reading at: Water level	Depth to water in feet	Draw-down in feet	Q = discharge gals/min	B.P.	Remarks (i.e. pumping rate, water temp., static level, etc.)
Jul 25		75	89.15	8.28	8.28		30		Static level 80.87
		90	89.18	8.31	8.30				
		105	89.18	8.31	8.30				
	12:00 Noon	120	89.20	8.33	8.32		30	910.7	
		150	89.21	8.34	8.33				
	1:00	180	89.22	8.35	8.34			910.7	Adjust cycles down
		210	89.25	8.38	8.38				
	2:00	240	89.26	8.39	8.39			910.5	
		300	89.21	8.34	8.33			910.8	Adjust pumping rate up.
	4:00	360	89.60	8.73	8.70			911.3	
		420	89.90	9.03	8.94			913.4	
	6:00	480	90.05	9.18	9.09			913.4	Adjust cycles down
		540	90.12	9.28	9.20			913.2	
	8:00 PM	600	90.58	9.71	9.63			913.3	Adjust pumping rate up
		660	90.67	9.80	9.67			915.1	
	10:00	728	90.70	9.83	9.68			915.7	
Jul 26		840	90.76	9.89	9.72			916.3	
	2:00 AM	960	90.79	9.92	9.72			917.2	
		1080	90.82	9.95	9.72			918.3	
	6:00	1200	90.85	9.98	9.73			919.0	
		1320	91.05	10.18	9.90			919.9	
	10:00	1440	91.03	10.16	9.90			919.6	
	2:00 PM	1680	91.01	10.14	9.92			918.4	
	6:00	1920	91.03	10.16	9.97			917.1	
	10:00 PM	2160	91.04	10.17	9.96			917.7	
Jul 27	4:00 AM	2520	91.06	10.19	10.00			917.2	
	10:00	2880	91.07	10.20	10.00			917.5	

DEPARTMENT OF THE ENVIRONMENT
WATER RESOURCES DIVISION
SOILS, GEOLOGY AND GROUNDWATER BRANCH

Water Level Measurements (field)

Well No. 68-13P Test conducted by: Hi-Rate Drilling Measured by: J. McKay & L. Taylor

Location of project Edson Well location: Lsd. or 1/4 13 Sec. 9 Tp. 17 R. 5 Mer. W.

Status Pumping (pumping or observation well) R = (distance from pumping well in feet and direction)

Date Jul 27/68 Page 3

Date	Time hrs. & mins.	Elapsed time in mins.	Tape Reading at: Meas. Point	Tape Reading at: Water level	Depth to water in feet	Draw-down in feet	Q = discharge gals/min		Remarks (i.e. pumping rate, water temp., static level, etc.)
Jul 27	4:00 PM	3240	91.01	9.97			30	917.2	Static level 80.87
	10:00	3600	90.97	9.90	10.10			917.5	
Jul 28	4:00 AM	3960	90.94	9.92	10.07			915.4	Adjust pumping rate up
	10.00	4320	91.10	10.09	10.23		30	915.2	
	4:00	4680	91.23	10.29	10.36			912.8	
	10:00 PM	5040	91.18	10.17	10.31			915.2	
Jul 29	4:00 AM	5400	91.16	10.22	10.29		30	912.8	
	10:00	5760	91.26	10.36	10.39			911.5	

WATER RESOURCES DIVISION
SOILS, GEOLOGY AND GROUNDWATER BRANCH

Water Level Measurements (field)
Well No. 68-13P Test conducted by: Hi-Rate Drilling Measured by: J. MacKay
Location of project Edson Well location: Lsd. or 1/4 13 Sec. 9 Tp. 53 R. 17 Mer. W. 5
Status Pumping well R = Recovery Date July 29/68 Page 1
(pumping or observation well) (distance from pumping well in feet and direction)

Date	Time hrs. & mins.	Elapsed time in mins.	Tape Reading at Meas. Point	Tape Reading at Water level	Depth to water in feet	Draw-down in feet	Q = discharge gals/min	B.P.	Remarks (i.e. pumping rate, water temp., static level, etc.)
Jul 29			t/t'	Drawdown		B.P. Corrected dd			Static level 80.87
	9:59 AM	0		91.26					
	10:00	.5	11,521		82.62	908.5			
		1	5,761	.48	81.35		.53		
		1.5	3,830	.17	81.04		.23		
		2	2,880	.12	80.99		.17		
		2.5	2,310	.11	80.98		.16		
		3	1,920	.11	80.98		.16		
		3.5	1,650	.11	80.98		.16		
		4	1,440	.11	80.98		.16		
		4.5	1,280	.11	80.98		.16		
		5	1,153	.11	80.98		.16		
		6	962	.10	80.97		.15		
		7	825	.09	80.96		.14		
		8	721	.09	80.96		.14		
		9	641	.08	80.95		.13		
		10	577	.08	80.95		.13		
		12	480	.08	80.95		.13		
		14	413	.08	80.95		.13		
		16	361	.08	80.95		.13		
		18	320	.08	80.95		.13		
		20	280	.08	80.95		.13		
		25	232	.08	80.95		.12		
		30	193	.06	80.93		.11		
		40	145	.06	80.93		.10		
		50	116	.06	80.93		.10		
	11:00 AM	60	97	.04	80.91	908.8	.08		

WATER RESOURCES DIVISION

SOILS, GEOLOGY AND GROUNDWATER BRANCH

Water Level Measurements (field)

Well No. 68-13P Test conducted by: Hi-Rate Drilling Measured by: J. MacKay

Location of project Edson Well location: Lsd. or 1/4 13 Sec. 9 Tp. 53 R. 17 Mer. W. 5

Status Pumping Well (pumping or observation well) R = Recovery (distance from pumping well in feet and direction) Date Jul 29/68 Page 2

Date	Time hrs. & mins.	Elapsed time in mins.	Tape Reading at		Depth to water in feet	Draw-down in feet	Q = discharge gals/min	B.P.	Remarks (i.e. pumping rate, water temp., static level, etc.)
			Meas. Point	Water level					
Jul 29		75	78	.01	80.88		.05		Static level 80.87
		90	65	.03	80.90		.07		
		105	56	.01	80.88		.05		
	12:00	120	49	.03	80.90		.06	909.3	
		150	39.4	.03	80.90		.07		
	1:00	180	33	.03	80.90		.08	908.8	
		210	28.5	.03	80.90		.07		
	2:00 PM	240	25	.03	80.90		.05	909.8	
	3	300	20.2	.03	80.90		.03	910.5	
	4	360	17	.02	80.89		.01	910.7	
	5	420	14.6	.03	80.90		.00	911.5	
	6:00 PM	480	13	.03	80.90		+.03	912.5	
Jul 30	9:00 AM	1380	5.2	.15	81.02		+.13	920.3	Static level 80.87

WATER RESOURCES DIVISION
SOILS, GEOLOGY AND GROUNDWATER BRANCH

Water Level Measurements (field)
Well No. 68-14P Test conducted by: Hi-Rate Drilling Measured by: G. Nielsen
Location of project Edson Well location: Lsd. or 1/4 13 Sec. 9 Tp. 53 R. 17 Mer. W. 5
Status Observation #1 R = 32' North Date Jul 25/68 Page 1
(pumping or observation well) (distance from pumping well in feet and direction)

Date	Time hrs. & mins.	Elapsed time in mins.	Tape Reading at: Meas. Point	Tape Reading at: Water level	Depth to water in feet	Draw-down in feet	Q = discharge gals/min	B.P.	Remarks (i.e. pumping rate, water temp., static level, etc.)
2				Corrected dd					
Jul 25	10:00 AM	.5		.40		.40		910.5	
		1		.49		.49			
		1.5		.51		.51			
		2		.53		.53			
		2.5		.57		.57			
		3		.57		.57			
		3.5		.57		.57			
		4		.57		.57			
		4.5		.57		.57			
		5		.57		.57			
		6		.58		.58			
		7		.56		.56			
		8		.58		.58			
		9		.58		.58			
		10		.58		.58			
		12		.60		.60			
		14		.59		.58			
		16		.58		.59			
		18		.59		.59			
		20		.60		.60			
		25		.61		.61			
		30		.61		.61			
		40		.62		.62			
		50		.62		.62			
	11:00	60		.63		.63		910.5	

DEPARTMENT OF THE ENVIRONMENT
WATER RESOURCES DIVISION
SOILS, GEOLOGY AND GROUNDWATER BRANCH

Water Level Measurements (field)
Well No. 68-14P Test conducted by: Hi-Rate Drilling Measured by: G. Nielsen, L. Taylor, J.McKay
Location of project Edson Well location: Lsd. or 1/4 13 Sec. 9 Tp. 53 R. 17 Mer. W. 5
States Observation #1 R = 32' North Date Jul 25/68 Page 2
(pumping or observation well) (distance from pumping well in feet and direction)

Date	Time hrs. & mins.	Elapsed time in mins.	Tape Reading at Meas. Point	Tape Reading at Water level	Depth to water in feet	Drawdown in feet	Q = discharge gals/min		Remarks (i.e. pumping rate, water temp., static level, etc.)
Jul 25		75				.62			Train went by
		90				.62			
		105				.62			
	12: Noon	120		.61		.62		910.7	
		150				.62			
		180		.61		.62		910.7	
		210				.65			
	2: PM	240		.62		.62		910.5	
		300		.64		.65		910.8	
	4: PM	360		.65		.68		911.3	
		420		.63		.70		913.4	
	6: PM	480		.64		.73		913.4	
		540		.68		.76		913.2	
	8: PM	600		.69		.77		913.3	
		660		.65		.78		915.1	
	10: PM	720		.61		.76		915.7	Train went by
Jul 26		840		.60		.76		916.3	
		960		.55		.75		917.2	
	4: AM	1080		.55		.78		918.3	
		1200		.55		.80		919.0	
		1320		.54		.82		919.9	
	10: AM	1440		.57		.83		919.6	
		1680		.58		.80		918.4	
		1920		.54		.73		917.1	
	10: PM	2160		.56		.77		917.7	
Jul 27		2520		.62		.81		917.2	
	10: AM	2880		.64		.84		917.5	

DEPARTMENT OF THE ENVIRONMENT
WATER RESOURCES DIVISION
SOILS, GEOLOGY AND GROUNDWATER BRANCH

Water Level Measurements (field)

Well No. 68-14P Test conducted by: Hi-Rate Drilling Measured by: J. McKay; L. Taylor

Location of project Edson Well location: Lsd. or 1/4 13 Sec. 9 Tp. 5317 R. 17 Mer. W. 5

Status Obeervation #1 (pumping or observation well) R = 32' north (distance from pumping well in feet and direction) Date Jul 27/68 Page 3

Date	Time hrs. & mins.	Elapsed time in mins.	Tape Reading at: Meas. Point	Tape Reading at: Water level	Depth to water in feet	Draw-down in feet	Q = discharge gals/min		Remarks (i.e. pumping rate, water temp., static level, etc.)
Jul 27	4: PM	3240		.66		.83		917.2	
		3600		.61		.81		917.5	
Jul 28	4: AM	3960		.64		.79		915.4	
		4320		.62		.76		915.2	
	4: PM	4680		.55		.62		912.8	
		5040		.45		.62		915.2	
Jul 29	4: AM	5400		.56		.63		912.8	
	10: AM	5760		.60		.63		911.5	

DEPARTMENT OF THE ENVIRONMENT
WATER RESOURCES DIVISION
SOILS, GEOLOGY AND GROUNDWATER BRANCH

Form: WR 4-3

Water Level Measurements (field)

Well No. 68-14P Test conducted by: Hi-Rate Drilling Measured by: G. Nielsen

Location of project Edson Well location: Lsd. or 1/4 ____ Sec. ____ Tp. ____ R. ____ Mer. W. ____

Status Observation #1 (pumping or observation well) R = 32' North (distance from pumping well in feet and direction) Date Jul 29/68 Page 1

Date	Time hrs. & mins.	Elapsed time in mins.	Tape Reading at: Meas. Point	Tape Reading at: Water level	Depth to water in feet	Draw-down in feet	Q = discharge gals/min	B.P.	Remarks (i.e. pumping rate, water temp., static level, etc.)
Jul 29			t/t'				Corrected dd		
	9:59 AM					.63	.68	908.5	
	10:00	.5	11521			.24	.29		
		1	5761			.07	.11		
		1.5	3830			.01	.06		
		2	2880			.00	.05		
		2.5	2310			+.01	.04		+ above static
		3	1920			+.01	.04		
		3.5	1650			+.02	.02		
		4	1440			+.02	.02		
		4.5	1280						
		5	1153			+.03	.01		
		6	962			+.03	.01		
		7	825						
		8	721			+.04	.00		
		9	641						
		10	577			+.04	.00		
		12	480						
		14	413						
		16	361			+.04	.00		
		18	320						
		20	280			+.04	.00		
		25	232			+.04	.00		
		30	193			+.04	.00		
		40	145			+.04	.00		
		50	116			+.05	+.01		
	11:00	60	97			+.06	+.02	908.8	

Form: WR-H-3

DEPARTMENT OF THE ENVIRONMENT
WATER RESOURCES DIVISION
SOILS, GEOLOGY AND GROUNDWATER BRANCH

Water Level Measurements (field)

Well No. 68-14P Test conducted by: Hi-Rate Drilling Measured by: G. Nielsen & J. McKay

Location of project Edson Well location: Lsd. or 1/4 ____ Sec. ____ Tp. ____ R. ____ Mer. W. ____

Status Observation #1 (pumping or observation well) R = 32' north (distance from pumping well in feet and direction) Date Jul 29/68 Page 2

Date	Time hrs. & mins.	Elapsed time in mins.	Tape Reading at		Depth to water in feet	Draw-down in feet	Q = discharge gals/min	B.P.	Remarks (i.e. pumping rate, water temp., static level, etc.)
			Meas. Point	Water level					
Jul 29		75	78			+.10	+.04		
		90	68			+.10	+.06		
		105	56			+.10	+.07		
	12: Noon	120	49			+.10	+.07	909.3	
		150	39.4			+.10			
		180	33			+.10	+.05	908.3	
		210	28.5			+.10			
	2:00 PM	240	25			+.10	+.08	909.8	
		300	20.2			+.10	+.10	910.5	
		360	17			+.10	+.11	910.7	
		420	14.6			+.10	+.13	911.5	
	6:00 PM	480	13			+.10	+.16	912.5	
Jul 30	9:00 AM	1380	5.2			-.05	+.23	920.3	

WATER RESOURCES DIVISION
SOILS, GEOLOGY AND GROUNDWATER BRANCH

Water Level Measurements (field)
Well No. 68-12P Test conducted by: Hi-Rate Drilling Measured by: L. Taylor
Location of project Edson Well location: Lsd. or 1/4 13 Sec. 9 Tp. 53 R. 17 Mer. W. 5
Status Observation #2 R = 103' South Date July 25/68 Page 1
(pumping or observation well) (distance from pumping well in feet and direction)

Date	Time hrs. & mins.	Elapsed time in mins.	Tape Reading at: Meas. Point	Tape Reading at: Water level	Depth to water in feet	Draw-down in feet	Q = discharge gals/min	B.P.	Remarks (i.e. pumping rate, water temp., static level, etc.)
Jul 25	10.00 AM	.5			77.25	0	Corrected dd	910.5	Static level 77.25
		1.5			77.25	0	0		
		2			77.25	0	0		
		3			77.25	0	0		
		3.5			77.25	0	0		
		4			77.25	0	0		
		4.5			77.25	0	0		
		5			77.25	0	0		
		6			77.25	0	0		
		7			77.25	0	0		
		8			77.25	0	0		
		9			77.25	0	0		
		10			77.25	0	0		
		12			77.25	0	0		
		14			77.26	0	0		
		16			77.25	0	0		
		18			77.26	.01	.01		
		20			77.27	.02	.02		
		25			77.27	.02	.02		
		30			77.27	.02	.02		
		40			77.28	.03	.03		
		50			77.28	.03	.03		
	11:00	60			77.28	.03	.03	910.5	
		75			77.28	.03			Static level 77.25
		90			77.28	.03			
		105			77.28	.03			
	12:00 Noon	120			77.28	.03		910.7	

DEPARTMENT OF THE ENVIRONMENT
WATER RESOURCES DIVISION
SOILS, GEOLOGY AND GROUNDWATER BRANCH

Water Level Measurements (field)
Well No. 68-12P Test conducted by: Hi-Rate Drilling Measured by: L. Taylor, J. McKay
Location of project Edson Well location: Lsd. or 1/4 13 Sec. 9 Tp. 53 R. 17 Mer. W 5
Status Observation #2 R = 103' south Date Jul 25/68 Page 2
(pumping or observation well) (distance from pumping well in feet and direction)

Date	Time hrs. & mins.	Elapsed time in mins.	Tape Reading at: Meas. Point	Tape Reading at: Water level	Depth to water in feet	Draw-down in feet	Q = discharge gals/min	B.P.	Remarks (i.e. pumping rate, water temp., static level, etc.)
	150	150			77.28	.03	Corrected dd		
		180			77.28	.03		910.7	
		210			77.28	.03			
	2:00 PM	240			77.28	.03		910.5	
		300			77.28	.03		910.8	
		360			77.30	.04		911.3	
		420			77.32	.03		913.4	
	6:00 PM	480			77.34	.05		913.4	
		540			77.39	.11		913.2	
		600			77.44	.15		913.3	
		660			77.54	.24		915.1	
	10:00 PM	720			77.60	.29		915.7	
Jul 26		840			77.60	.28		916.3	
		960			77.72	.40		917.2	
		1080			77.79	.45		918.3	
		1200			77.90	.55		919.0	
		1320			77.91	.56		919.9	
	10:00 AM	1440			77.97	.62		918.6	
		1680			78.08	.74		918.4	
		1920			78.14	.82		917.1	
	10:00 PM	2160			78.23	.90		917.7	
Jul 27		2520			78.32	1.00		917.2	
	10:00 AM	2880			78.45	1.13		917.5	
		3240			78.49	1.19		917.2	Static level 77.25
		3600			78.53	1.23		917.5	
Jul 28		3960			78.58	1.30		915.4	
	10:00 AM	4320			78.62	1.38		915.2	

Form: WR-H-3

DEPARTMENT OF THE ENVIRONMENT
WATER RESOURCES DIVISION
SOILS, GEOLOGY AND GROUNDWATER BRANCH

Water Level Measurements (field)

Well No. 68-12P Test conducted by: Hi-Rate Drilling Measured by: J. MacKay & L. Taylor

Location of project: Edson Well location: Lsd. or 1/4 13 Sec. 9 Tp. 53 R. 17 Mer. W. 5

Status: Observation #2 (pumping or observation well) R = 103' south (distance from pumping well in feet and direction) Date July 25/68 Page 3

Date	Time hrs. & mins.	Elapsed time in mins.	Tape Reading at: Meas. Point	Tape Reading at: Water level	Depth to water in feet	Draw-down in feet	Q = discharge gals/min	B.P.	Remarks (i.e. pumping rate, water temp., static level, etc.)
		4680			78.65	1.42		912.8	
	10:00 PM	5040			78.69	1.46		915.2	
Jul 29		5400			78.75	1.53		912.8	
	10:00 AM	5760			78.80	1.57		911.5	

DEPARTMENT OF THE ENVIRONMENT
WATER RESOURCES DIVISION
SOILS, GEOLOGY AND GROUNDWATER BRANCH

Water Level Measurements (field)
Well No. 68-15P
Location of project Edson
Status Observation #3 (pumping or observation well)
Test conducted by: Hi-Rate Drilling
Well location: Lsd. or 1/4 1 Sec. 17 Tp. 53 R. 17 Mer. W. 5
R = 970' north west (distance from pumping well in feet and direction)
Measured by: M. Magas
Date Jul 25/68 Page 1

Date	Time hrs. & mins.	Elapsed time in mins.	Tape Reading at: Meas. Point	Tape Reading at: Water level	Depth to water in feet	Draw-down in feet	Q = discharge gals/min	B.P.	Remarks (i.e. pumping rate, water temp., static level, etc.)
Jul 25							Corrected dd		Static level 91.30
	10:00	.5			91.30	0	0	910.5	
		1			91.30	0	0		
		1.5			91.30	0	0		
		2			91.30	0	0		
		2.5			91.30	0	0		
		3			91.30	0	0		
		3.5			91.30	0	0		
		4			91.30	0	0		
		4.5			91.30	0	0		
		5			91.30	0	0		
		6			91.30	0	0		
		7			91.30	0	0		
		8			91.30	0	0		
		9			91.30	0	0		
		10			91.30	0	0		
		12			91.30	0	0		
		14			91.30	0	0		
		16			91.32	0.02	.02		
		18			91.32	0.02	.02		
		20			91.32	.02	.02		
		25			91.34	.04	.04		
		30			91.35	.05	.05		
		40			91.38	.08	.08		
		50			91.40	.10	.10		
	11:00 AM	60			91.41	.11	.11	910.5	
		75			91.41	.11			Static level 91.30

Form: WR-H-3

DEPARTMENT OF THE ENVIRONMENT
WATER RESOURCES DIVISION
SOILS, GEOLOGY AND GROUNDWATER BRANCH

Water Level Measurements (field)
Well No. 68-15
Location of project Edson
Status Observation #3 (pumping or observation well)
Test conducted by: Hi-Rate Drilling
Well location: lsd. or 1/4 1 Sec. 17 Tp. 53 R. 17 Mer. W. 5
R = 970' North west (distance from pumping well in feet and direction)
Measured by: L. Taylor & J. McKay
Date Jul 25/68
Page 2

Date	Time hrs. & mins.	Elapsed time in mins.	Tape Reading at: Meas. Point	Tape Reading at: Water level	Depth to water in feet	Draw-down in feet	Q = discharge gals/min		Remarks (i.e. pumping rate, water temp., static level, etc.)
		90			91.41	.11	.11		
		105			91.42	.12	.11		
	12: Noon	120			91.42	.12	.11	910.7	
		150			91.42	.12	.11		
		180			91.42	.12	.11	910.7	
		210			91.42	.12	.12		
	2:00 PM	240			91.48	.18	.18	910.5	
		300			91.48	.18	.17	910.8	
		360			91.45	.15	.12	911.3	
		420			91.45	.15	.11	913.4	
	6:00 PM	480			91.45	.15	.11	913.4	
		540			91.47	.17	.14	913.2	
		600			91.50	.20	.16	913.3	
		660			91.54	.24	.19	915.1	
	10:00 PM	720			91.58	.28	.22	915.7	
Jul 26		840			91.59	.29	.22	916.3	
		960			91.60	.30	.23	917.2	
	4:00 AM	1080			91.61	.31	.22	918.3	
		1200			91.63	.33	.23	919.0	
		1320			91.64	.34	.24	919.9	
	10:00 AM	1440			91.65	.35	.25	919.6	
		1680			91.62	.32	.23	918.4	
		1920			91.60	.30	.23	917.1	
	10:00 PM	2160			91.58	.28	.20	917.7	
Jul 27		2520			91.52	.22	.15	917.2	
	10:00 AM	2880			91.53	.23	.16	917.5	
		3240			91.55	.25	.20	917.2	Static level 91.30

DEPARTMENT OF THE ENVIRONMENT
WATER RESOURCES DIVISION
SOILS, GEOLOGY AND GROUNDWATER BRANCH

Water Level Measurements (field)

Well No. 68-15P Test conducted by: Hi-Rate Drilling Measured by: L. Taylor & J. McKay

Location of project Edson Well location: Lsd. or 1/4 1 Sec. 17 Tp. 53 R. 17 Mer. W. 5

Status Observation #3 (pumping or observation well) R = 970' Northwest (distance from pumping well in feet and direction) Date July 27/68 Page 3

Date	Time hrs. & mins.	Elapsed time in mins.	Tape Reading at: Meas. Point	Tape Reading at: Water level	Depth to water in feet	Draw-down in feet	Q = discharge gals/min	B.P.	Remarks (i.e. pumping rate, water temp., static level, etc.)
	10: PM	3600			91.41	.11	.06	917.5	
Jul 28		3960			91.35	.05	.02	915.4	
	10: AM	4220			91.29	-.01	-.02	915.2	
		4680			91.26	-.04	-.02	912.8	
	10: PM	5040			91.29	-.01	+.01	915.2	
Jul 29		5400			91.31	+.01	+.04	912.8	
	10: AM	5760			91.30	.00	+.02	911.5	